# THE ROLE OF METALS IN ANCIENT GREEK HISTORY

BY

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# INTRODUCTION

The motive for writing this book arises from a desire to offer an multidisciplinary approach—it is an attempt to argue the role of metals in the history of Greek society using the widest possible variety of sources: the evidence of ancient writers and epigraphical material, archaeological data: the excavated remains of workshops and hoards, archaeometallurgical finds: the results of studies of ancient mines and analyses of ancient metal objects; bronze plastics and jewelry, coins etc. At present, at a time when the source basis of archaeological investigations is being constantly developed and more and more specialised monographic studies appear, the very possibility of such approach may be called into question. It is quite natural that the narrow specialization of modern science makes such projects difficult to realize. However, this approach should remain our aim. Otherwise there will be a steady tendency to reduce the source base for scholarship which would finally be limited to only a single sort of source, which seems unacceptable.

Such "theoretical arguments", with a direct connection with this book, appear more and more frequently. For example, A.M. Snodgrass has recently called on archaeologists to use surface surveys rather than excavations, and calls into doubt the value of the latter because of the incompleteness of data and the subjectivity of interpretation[1]. In a note, discussing Snodgrass' thesis, M. Popham stresses that surveys are only one of the many possible ways of studying the Greek past[2]. S.C. Humphreys justly makes the following remarks: that classical studies are no longer the dominant model for all studies of antiquity. The divergence of ancient history from the main stream of historical research and the separation of the study of ancient texts from modern philology are quite evident. Only recently has there been any noticeable tendency towards rapprochement between. According to S.C. Humphreys, the division of Classical archaeology from the main body of archaeological studies is not so clear[3]. The specifics of the development of Classical archaeology (*tradizione winckelmanniana*)

[1] A.M. Snodgrass, 1987.
[2] M. Popham, 1990, 34.
[3] S.C. Humphreys, 1978, 128-129.

have led not only to a narrowing of the source base, but also to the practical exclusion of problems related to industry and trade from the spheres of investigation[4]. The methods worked out by non-Classical (Prehistoric, American, Provincial-Roman etc.) archaeology to compensate for a lack of written sources and intricate forms of art are applicable to the study of ancient world[5].

A.M. Snodgrass stresses that archaeology needs various methods for the control of hypotheses. In classical archaeology there is a need for a generalizing approach. Most branches of archaeology study such considerable time spans that they are inevitably discussed as cultures in anthropology. At the same time, there are epochs in the past where the condition of the sources allows archaeologists to pose original questions and to study the material evidence in their attempts to answer these questions. Classical archaeology studies perhaps the most significant of such periods[6].

Most recently I. Morris has come to a similar conclusion: "Classicists who rely mainly on texts and those who rely mainly on archaeological evidence often act as if they were two sides in a competition, and one day an impartial observer will judge whose evidence is best and who wins the game. We have to take our evidence where we can find it; and my argument here has been that we need to combine as many genres as possible. Historians who write about community without using material evidence for rituals and archaeologists who write their monographs without reference to historical concepts both lose out... If there is a kind of evidence which renders material culture superfluous... we certainly do not have it from classical antiquity"[7].

The scant informational value of a single sort of source for the study of general problems in the history of ancient society is demonstrated by the following example. Often entire schools of ancient metalworking can be represented by several pieces. In this way the idea may subconsciously arise that the role of metals in ancient society was insignificant. Archaeological data in this case cannot provide an objective picture, given that a considerable part of ancient gold and silver artefacts was melted down and reused in later periods[8]. In modern scholarship there is a clear tendency to use various approaches in the investigation of this or that

4 W.-D. Heilmeyer, 1986, 95-98.

5 S.C. Humphreys, 1978, 129; N. Wilkie, 1991, 307.

6 A.M. Snodgrass, 1987, 34-35.

7 I. Morris, 1992, 200-201.

8 See: M. Vickers, 1990.

category of objects. John Boardman for example has only recently stressed the applicability of art-historical and archaeological approaches in the study of ancient jewelry[9].

## *The Aims of this Study*

The main task of this work is to analyze the role of various metals in the context of Greek economic life, politics, culture and art, to trace the movement of metal from ore to finished objects, including works of art, and to show the relations between the regions where metals were extracted and the centres of metalworking, the structure of the workshops and the connections between them and the role of the workshops in economic life at different stages in Greek history.

The chronological span of this study is the 8th-1st centuries B.C., i.e. from the beginning of the period of Greek colonization till the end of the Hellenistic era. The geographical scope of the work is the Greek oikumene.

In each chapter I shall discuss all the known modern material concerning mining, metallurgy and metalworking on the basis of multidisciplinary studies of various categories of sources, not only narrative sources, but new archaeological data (including that from underwater investigations) and archaeometallurgical sources as well (for instance, I shall use the results of applying modern techniques from the natural sciences to trace the movements of metals). Stylistic analyses of different categories of metal artefacts (sculptures, small plastics, vessels, jewelry etc.) are used to differentiate schools and centres of metalworking and to complete the picture of the development of metal workshops known from written documents and archaeological data. The mapping of finds of metal objects onto information from narrative sources allows one to argue for models for the distribution of articles of gold, silver, bronze etc. The materials analyzed provide a basis for historical conclusions about the influence of mining and metalworking, the manufacture and distribution of metal objects on the economic, political and cultural evolution of Greek society, about the links of these processes with such historical events as colonization, wars, and the political relations of the various Greek states.

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[9] J. Boardman, 1991.

Some general remarks should be made. This book cannot be regarded as a definitive survey of the history of mining and metallurgy in the Greek world. Many questions still await a solution, so this is rather an interim report. I would also like to mention that particular metals, like copper alloys and precious metals, have received more attention, while iron is less frequently discussed in the book. This is explained by the fact that articles made of bronze and precious metals offer better possibilities for stylistic analysis because of a wider variety of shapes, moreover objects made of bronze, silver, and gold can be studied by comparisons with casting moulds and matrices. This kind of analysis gives a unique chance to address questions about the centres of manufacture, which I am trying to demonstrate here. The natural sciences with their new approaches also present much more conclusive possibilities for analyzing copper-based alloys and precious metals than iron. The study of iron objects is, thus, a task for scholars in the future. Recently an attempt was undertaken to create an interdisciplinary synthesis in studying pre-industrial ironmaking. The co-authors of this, W. Rostoker and B. Bronson, who represent two different disciplines—technology and anthropology, set themselves the aim not "to revise history, but rather to construct a stronger foundation upon which better history can be written by those professionally trained to do so"[10]. However, the history of ancient Greek ironmaking has not found reflection in this book. I do not pretend to give a systematic survey of the techniques of mining and geology. A fair quantity of systematic information about these problems is to be found in general books on the history of ancient mining, which I will discuss briefly below. I shall concentrate my attention on the role of metals in history, a problem, which to my mind, has received far less attention in the scholarly literature. In this respect I shall really be dwelling more on finished articles, from tools, arms, and utensils to works of art, and shall try to discuss questions concerning manufacturing centres, production and distribution of finished products.

Given then the main tasks outlined above, the book has the following fundamental structure:

1.1. Mining according to ancient narrative sources.

1.2. Mining according to the data of archaeological and archaeometallurgical studies.

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[10] W. Rostoker, B. Bronson, 1990.

2.1. Metalworkshops according to the data of archaeological and archaeometallurgical studies.

2.2. Workshops according to the results of stylistic analyses of metal artefacts.

2.3. Historical conclusions about the development of metalworking in the period discussed (on the basis of an multidisciplinary study of sources).

3.1. The prices of metals and their dynamics.

3.2. The trade in metals (as raw materials) (on the basis of an multidisciplinary study of the sources).

3.3. The distribution of metal objects (on the basis of an multidisciplinary study of the sources).

4. Historical conclusions about the role of metals in the economic, political and cultural development of Greek society in the period under discussion.

The book was written in 1990-91 in the Institute of Provincial-Roman Archaeology, University of Freiburg, Germany and State Pushkin Museum of Fine Arts, Moscow. The manuscript was reworked during my stay at the German Archaeological Institute in Rome in 1991 and finalized during my fellowship at the Archaeological Institute of the University of Freiburg in 1994. In the meantime the manuscript was discussed in the Department of Art and Archaeology, Pushkin Museum of Fine Arts and in the Center for Comparative Studies of Ancient Civilizations, Russian Academy of Science and in May 1993 was defended as habilitation thesis at the Oriental Institute, Russian Academy of Scienes. I'd like to thank cordially Alexander von Humboldt-Stiftung (Bonn), Deutsche Forschungsgemeinschaft (Bonn), Deutsches Arcäologisches Institut, Römische Abteilung, British Academy, for the fellowships which permitted me to study in the libraries and museums in Germany, Italy, France, Spain, Great Britain, Switzerland. I am especially thankful to Profs Dr. Hans-Ulrich Nuber and Volker Michael Strocka, who have hospitably placed at my disposal working places at the Institutes of Provincial-Roman Archaeology (1989/90) and Archaeological Institute (1994), Albert-Ludwigs-Universität, Freiburg. This work would have been impossible without the friendly support of my colleagues: S.C. Bakhuizen (Amsterdam), B. Barr-Sharrar (New York), J. Boardman (Oxford), P.C. Bol (Frankfurt), G.M. Bongard-Levin (Moscow), S. Boucher (St. Cyr au Mont d'Or), F. Burkhalter (Rome), P.T. Craddock (London), C. von Hees-Landwehr (Freiburg), W.-D. Heilmeyer

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## CHAPTER ONE

# HISTORIOGRAPHY AND MODELS OF STUDY

### *1.1. Historiographical Survey*

The writing of an historiographical survey is a rather difficult task in view of the desire alluded to above to make use of various categories of sources.

The first general works on the history of ancient metalworking are of the German school of the last century, and are represented, in particular, by the fundamental study by H. Blümner[1], which was the first to be based on ancient written sources as well as on inscriptions and the limited archaeological material known at that time. An example of a similar multidisciplinary approach relevant to the theme of the present monograph are the three-volume detailed monograph by R.J. Forbes and his book devoted to metallurgy in antiquity[2].

I should also mention chapters on mining and metallurgy in general books devoted to the history of ancient technology, such as the recently published book by H. Schneider[3].

Historical studies of ancient crafts also have a tradition in late 19th- century works. The historiography of this field has recently been discussed comprehensively by L. Neesen and S. Mrozek[4]. Studies concerning ancient Greek mining also first appeared in the last century. They were based mainly on references in ancient writers, inscriptions, papyri, and limited archaeological material. I shall mention as examples the famous monographs by É. Ardallion about Laurion, K. Fitzler's book on the Egyptian mines of the Ptolemaic and Roman periods, the monograph by O. Davies about the Roman mines of Europe which, however, contains some important information about the period treated here[5]. Studies of ancient mining are to be found nowadays in publications of vary-

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1 H. Blümner, 1887.

2 R.J. Forbes, 1950; 1963; 1964; 1964a.

3 H. Schneider, 1992, 71-95.

4 L. Neesen, 1989, 1-21; S. Mrozek, 1989.

5 É. Ardallion, 1897; K. Fitzler, 1910; O. Davies, 1935.

ing characters. Traditional thought is represented by the works of J. Ramin and J.F. Healy[6], which are based mainly on narrative sources, and to a lesser extent on archaeological data.

The recently published book by R. Shepherd begins with a general overview of the geology, practice and administration of mining and continues with specific sections on the Greek world and the Roman Empire. However it offers a great deal of quasi political-socio-economic background that abounds with oft-repeated platitudes, mistakes and trivialities[7]. Other publications, for instance, those by C. Conophagos[8], concentrate principally on the technical aspects of the problem. Archaeometallurgical trends are represented by the works from, for example, the Max-Planck Institute at Heidelberg, the Deutsches Bergbau-Museum at Bochum, and Oxford University and aim to correlate field studies of mines with the study of metal objects in an attempt to identify their ore sources[9]. The collaborative studies of Siphnian and Thasian mining published by the Deutsches Bergbau-Museum[10] along with purely monographic publications present articles which aim to generalize the results of study on a historical level. A similar multidisciplinary study which also uses the results of the archaeometallurgical approach is H. Kalcyk's monograph devoted to the history of the Laurion mines[11].

Another important direction in research is that of the field study of the archaeological remains of ancient metal workshops. Separate publications and unpublished materials, primarily on the casting of bronze statues, have been recently surveyed by W.-D. Heilmeyer, G. Zimmer, C.C. Mattusch, and D. Haynes[12].

Greek bronzes and articles of toreutics and jewelry are published in the catalogues of museums and private collections, as well as in auction and exhibition catalogues. One may note the high quality of some recently published detailed catalogues like those devoted to Greek, Etruscan and Roman small bronzes and

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6 J. Ramin, 1977; J.F. Healy, 1978.

7 R. Shepherd, 1993; cf. P.T. Craddock, 1994, 188.

8 C. Conophagos, 1980.

9 See, e.g.: E. Pernicka, 1987; E. Pernicka et al., 1984; E. Pernicka, G.A. Wagner, 1985; 1988; T.C. Seeliger et al., 1985; G.A. Wagner et al., 1986. See also my survey: M.Yu. Treister, 1987.

10 *Silber, Blei und Gold auf Siphnos*, 1985; *Antike Thasos*, 1988.

11 H. Kalcyk, 1982.

12 See, for instance: W.-D. Heilmeyer, 1986, 95-109; C.C. Mattusch, 1988; G. Zimmer, 1990; D. Haynes, 1992.

helmets[13]. Publications in series of excavation reports or in special monographs devoted to studies of the Greek sanctuaries at Olympia, Samos, Thasos, and Thebes or in Greek cities, like Olynthus or Delos, and to barbarian necropoleis with Greek imports[14] are extremely important for the systematisation of artefacts. Very significant for the reconstruction of Greek trade in metal objects are underwater finds of ancient shipwrecks containing bronze sculptures and vessels[15].

R. Laffineur, R. Higgins, D. Ogden, B. Deppert-Lippitz, and P.G. Guzzo focus in their surveys of Greek and Roman jewelry attention on the chronological evolution of types and styles[16]. Greek silver and gold ware is discussed by D. Strong and A. Oliver[17]. I should mention special publications devoted to Hellenistic toreutics[18]. Some articles have dealt with the study of the separate categories of the jewelry found in a given region, e.g. beads and spiral pendants from Bosporus[19], or earrings from Thrace and the Central Balkans[20].

Among general works devoted to Greek bronze plastics I would mention first of all a fundamental monograph by C. Rolley, which chronologically covers the whole period discussed in this study[21], and marks a major advance on the well-known works of W. Lamb and J. Charbonneaux[22], books by W. Fuchs and J. Floren on Greek Geometric and Archaic plastics[23] and by R. Thomas on Greek bronze statuettes[24]. Greek bronze sculpture of the Archaic

[13] *The Gods Delight*, 1988; *Antike Helme*, 1988.

[14] See, e.g.: Olympia (P.C. Bol, 1978; 1989; M. Maass, 1978; W. Gauer, 1984; 1991; W.-D. Heilmeyer, 1979; H.-V. Herrmann, 1979; H. Philipp, 1981; A. Moustaka, 1985; E. Kunze, 1991), Samos (U. Jantzen, 1972; H. Kyrieleis, 1986; H. Kyrieleis, W. Röllig, 1988), Thasos (C. Dunant, C. Rolley, 1987), Thebes (B. Schmaltz, 1980), Olynthus (D.M. Robinson, 1941), Delos (G. Siebert, 1973; 1979; 1988), Scythian and Thracian necropoleis (X.S. Gorbunova, 1971; N.L. Grach, 1984; V. Vasilev, 1988).

[15] See, for instance: W. Fuchs, 1963; P.C. Bol, 1972; C.J. Eiseman, B.S. Ridgway, 1987; *Objets métalliques sur les épaves antiques*, 1984; A. Arribas et al., 1987; A. Arribas, 1989; 1989a.

[16] R. Laffineur, 1978; R. Higgins, 1980; J. Ogden, 1982; B. Deppert-Lippitz, 1985; P.G. Guzzo, 1993.

[17] D. Strong, 1966; A. Oliver, 1977.

[18] C. Reinsberg, 1980; M. Pfrommer, 1982; 1983; 1987; 1990, 1993, 1993a; M. De Juliis, 1989a; E. Formigli, W.-D. Heilmeyer, 1990.

[19] P.F. Silant'eva, 1976; 1979.

[20] M. Dimitrova, 1989; R. Vasić, 1990.

[21] C. Rolley, 1986a.

[22] W. Lamb, 1929; J. Charbonneaux, 1962.

[23] W. Fuchs, J. Floren, 1987.

[24] R. Thomas, 1992.

period has been discussed in monographs by J. Boardman, C.C. Mattusch, and B. S. Ridgway[25], those of the Classical period are treated in works by J. Boardman, C.J. Eiseman, B. S. Ridgway, and C. Rolley[26], while the studies of N. Himmelmann and B.S. Ridgway discuss problems of Hellenistic bronze statuary[27].

The problems of small Greek bronze plastics were discussed in 1988 at the Malibu symposium[28]. Archaic horse figurines are discussed in a dissertation by C. von Wangenheim[29], athlete statuettes of the Late Archaic and Severe Style by R. Thomas[30]. H.-G. Niemeyer has analyzed figures of Athena Promachos of the same period[31] and R. Tölle-Kastenbein looked at Early Classical peplophores[32]. Specialist studies have been devoted to Archaic Laconian and Arcadian plastics[33]. Of special importance for the methodology of study is a monograph by J.-L. Zimmermann about Greek bronze horse figurines of the Geometric period, in which the author on the basis of a thorough stylistic analysis distinguishes various regional schools and discusses the complicated problems of the interrelations of their metalworking centres[34].

A series of fundamental books has been devoted to Greek bronze ware. While in some studies analyses are given of separate categories of vessels, like hydriai[35], oinochoai[36], or kraters[37], other works focus on regional finds or the production of a particular manufacturing centre, for instance, of Magna Graecia in the Archaic period[38], or Corinth[39]; finds of "*Schnabelkannen*" in Italy are discussed by B. Bouloumié and B. Shefton[40].

Among publications devoted to various types of bronze utensils

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25 J. Boardman, 1978; C.C. Mattusch, 1988; B.S. Ridgway, 1971; 1977.

26 J. Boardman, 1985; C.J. Eiseman, B.S. Ridgway, 1987; B.S. Ridgway, 1985; see also: *Due Bronzi di Riace*, 1985; C. Rolley, 1990.

27 N. Himmelmann, 1989; B.S. Ridgway, 1990.

28 B. Barr-Sharrar, 1990.

29 C. von Wangenheim, 1988.

30 R. Thomas, 1981.

31 H.-G. Niemeyer, 1960.

32 R. Tölle-Kastenbein, 1980.

33 M. Herfort-Koch, 1986; F. Felten, 1988.

34 J.-L. Zimmermann, 1989.

35 E. Diehl, 1964; C.M. Stibbe, 1992.

36 T. Weber, 1983.

37 K. Hitzl, 1982.

38 C. Rolley, 1982.

39 I. Vokotopoulou, 1975.

40 B. Bouloumié, 1973; B. Shefton, 1979.

I would mention studies of bronze mirrors[41], Hellenistic decorative busts[42], bronze details of couches[43] and strigilla[44].

A catalogue of an exhibition of helmets published in conjunction with the XIIIth International Congress of Classical Archaeology presents the most detailed publication on helmets yet from the point of view of the evolution of types, and their chronological and spatial distribution[45]. Of general works devoted to this category of armour I shall mention a book by P. Dinstis about Hellenistic helmets[46]. The armour of the Greek cities of Italy and of the local populations is discussed by M. Suano, P. Connoly, A. Bottini, and J.-L. Zimmermann[47]. D. Baatz is publishing details of catapults and their reconstructions[48].

New studies of Greek bronze articles are published periodically in the proceedings of international symposia on ancient bronzes. Of special importance for the topic of our study are the published proceedings of colloquia at Lyon (1976), Lausanne (1978), Berlin (1980), and Vienne (1986)[49]. Also very useful are the regular surveys of the publications of Greek, Etruscan and Roman bronzes in "Revue archéologique"[50].

Another important source of studies is formed by analyses of the metal composition of bronze objects. Already in the late 18th century M. Klaproth had published chemical analyses of the metal of Roman mirrors, while 1869 saw the publication of a first general work by E. von Bibra[51]. The results of chemical analyses of bronzes formed part of the books written by H. Blümner and A. Neuburger[52]. On the whole works published in the last century are characterized by a low level of generalization: the results of chemical analyses, very incomplete and imprecise, remained practically unused in the reconstruction of an historical picture of the evolution of ancient metalworking. All the same, it was in the 19th

41 W. Züchner, 1942; P. Oberländer, 1967; Z.A. Bilimovich, 1973; F. Cameron, 1979; L.O.K. Congdon, 1981; G. Zimmer, 1991.
42 B. Barr-Sharrar, 1987.
43 S. Faust, 1989.
44 E. Kotera-Feyer, 1993.
45 *Antike Helme*, 1988.
46 P. Dinstis, 1986.
47 M. Suano, 1986; P. Connoly, 1986; A. Bottini, 1989; J.-L. Zimmermann, 1989a.
48 D. Baatz, 1979; 1982; 1985.
49 See the survey: L.I. Akimova, M.Yu. Treister, 1987.
50 C. Rolley, 1983a; 1984a; 1985; 1986; 1987; 1988; 1989; 1990a; 1991; 1993.
51 E. von Bibra, 1869.
52 H. Blümner, 1887; A. Neuburger, 1919.

century that the foundation was laid of the modern study of ancient bronzes. In the first half of the 20th century a few works were published devoted to the study of the composition of metals. I shall mention O. Davies' article about the composition of early Greek bronzes[53]. Special attention should be paid to the monograph by E.R. Caley about the metal composition of Greek and Roman coins based on the results of fairly precise chemical analyses[54]. This monograph has still not lost its significance today. Since the second half of the 1950s interest has been increasing in the study of the composition of ancient metals.

In recent decades there has been a spread of the study of metal composition using, for example, spectral, lead isotope, and metallographical analyses, and computer tomography.[55]. Analyses of metal composition have been made in several specialist fields. In notes and articles devoted to the publication of statues, mirrors, lamps etc. various results of analyses have been published[56]. At the same time in the 50s and 60s systematic programmes of study of ancient bronzes were started in some countries (for instance, in France and the Netherlands). Special attention was paid to the study of the metal of coins, however, the accent lay on the study of Roman and Provincial-Roman coinage[57]. In the 70s and 80s the works of the Research Laboratory of the British Museum rose in importance. P.T. Craddock presented a thesis with the title "Copper Alloys of the Classical World" and afterwards published some sections of it and the results of analyses in a series of articles[58]. The articles by P.T. Craddock are characterized by the very serious attention given to the methodology of spectroanalytical study. Greek, Etruscan and Roman bronzes are discussed by category: tools, weapons, statuettes, ornaments, mirrors, and vessels, and each category is treated by chronological period: Archaic, Classical, Hellenistic etc. However, the author did not attempt to categorise the whole mass of bronzes according to their spatial distribution and, therefore, did not solve the problem of how to identify manufacturing centres and imported articles. On the whole,

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[53] O. Davies, 1938.

[54] E.R. Caley, 1939.

[55] See bibliographical surveys: W.-D. Heilmeyer, 1986, 120-122; E.A. Sanpaolo, 1990, 104-107.

[56] See, e.g.: L.O.K. Congdon, 1967.

[57] See the survey: M.Yu. Treister, 1988b.

[58] See: P.T. Craddock, 1976; 1977; 1988; P.T. Craddock, A. Giumlia-Mair, 1988; P.T. Craddock, A.M. Burnett, K. Preston, 1980.

the work of P.T. Craddock has been limited to a discussion of the development of alloy recipes. Dissertations by S.Ya. Ol'govskij, M.Yu. Treister[59] are also based on large series of analyzes of bronze objects (originating from the North Pontic area) and in general demonstrate the regularity of the dynamics of recipes of alloys, characteristic of the Greek world, however, they also stress the regional peculiarities of metalworking in the North-Western Pontic area and in Bosporus. In these studies an attempt is made to discuss a metalworking in the context of the socio-economic and political history of the separate regions of the ancient world. From this point of view those works devoted to the study of the metal composition of Geometric and Orientalizing bronzes, in which technological investigation was not the main aim, but a means for solving problems of the relations between Eastern and Greek metalworking in the 9th-7th centuries B.C., are of special interest[60]. Such studies form an important source, which allows through correlation with other data the solution of certain problems of ancient history. The future of this field certainly lies in the development of computer databases like, for instance, the program "*Cuprum*" in Italy[61].

Among comparatively recent publications, in which reconstructed the history of Greek bronzeworking on the basis of a wide range of sources is a book by P.C. Bol, which should be mentioned despite some shortcomings[62]. The role of metals and the place of metalworking in the establishment of early Greek art was recently discussed in a fundamental monograph by S. Morris[63].

### *1.2. Problems of Studies*

In general, ancient production and distribution may be divided into several successive stages:

1) ore mining;

2) metal extraction;

3) the transportation of metal to centres of metalworking and storage;

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[59] S.Ya. Ol'govskij, 1982; M.Yu. Treister, 1984; 1988b.
[60] C. Rolley et al., 1983; E. Magou et al., 1986; 1991.
[61] E.A. Sanpaolo, 1990.
[62] P.C. Bol, 1985.
[63] S. Morris, 1992.

4) the manufacture of metal objects and coins;

5) the distribution and re-distribution of metal in the form of ingots, coins or artefacts.

Here follows an attempt to construct models for the production and distribution of metals and metal objects which are characteristic of Classical antiquity.

## *1.3. Models of Production*

### *1.3.1. Mining and Metallurgy*

P. Raber, in discussing the data for copper mining in Cyprus in the Ancient and Medieval periods[64], considers three possible models for the organization of mining and metallurgy: 1) state-organized, large-scale, full-time industry; 2) local, village-based, seasonal industry; and 3) transitional, mobilized, local industry. The chief characteristics of each type of industry may be summarized here briefly:

The First Model

1) The exploration and processing of ores occur on a large scale: an annual production of hundreds or thousands of tons is common.

2) Mining and smelting are full-time, specialized occupations.

3) Production centres are few, large, and fixed so as to minimize the costs of resource procurement and distribution, thus favouring a nucleated pattern.

4) The labour force is large and specialized. It includes full-time technical specialists, administrative personnel, and a large body of unskilled or semi-skilled labourers (slave labour in the case of Hellenistic and Roman production).

5) There is a large, centrally-organized support system providing fuel, roads and transport, storage facilities, etc.

The archaeological correlates of such an industry should be as follows:

1) The evidence should be concentrated in a few large sites, near to substantial ore and fuel supplies and chosen with regard to transportation routes. The sites should be large in area and in

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64 P. Raber, 1987, 301-302.

the scale of their characteristic features: specialized buildings, mine workings, waste dumps, furnaces, etc.

2) The characteristic facilities of such large operations should leave distinctive traces: specialized buildings for storage, the processing of raw materials, and housing, specialized metallurgical facilities (permanent furnaces) and equipment (such as tongs, crucibles, and tuyeres).

3) Extensive and patterned alteration of the landscape should be evident in the form of mine workings, quarries, deforestation, etc.

### The Second Model

1) Production is small in scale and seasonal: total annual production amounts to several tons of metal.

2) Production sites are small, dispersed, and not associated with a settlement of full-time specialists but with a pre-existing village or town.

3) The labour force is relatively small and composed of part-time specialists primarily engaged in subsistence-orientated activities or other tasks.

4) There are few large or permanent facilities. A variety of techniques may be used but facilities are few, generally small, often temporary, and constructed from locally available materials.

5) The industry is maintained by a local support system, eliminating the need for specialized housing, storage, and transportation.

6) Production is scaled to local consumption and scheduled according to local demand and the requirements of subsistence activities. It is, therefore, seasonal or occasional.

Archaeological features associated with this type of industry should include the following:

1) There should be many small metallurgical sites located to exploit local ore deposits and within easy access of a village or town.

2) There should be little evidence of substantial or specialized architecture or metallurgical facilities. Furnaces will be small and simple and may not be evident, since old furnaces may be demolished after use or incorporated into the next season's constructions.

3) Quantities of slag, gangue, and other waste or by-products at any site will be small, reflecting the low level of production.

4) The evidence for distribution of metal, when present, should indicate primarily local consumption.

### The Third Model

This model is more speculative and poorly documented—in part, because it is transitional—but several examples may be proposed. Essentially it is a local industry mobilized for the purposes of a state or other central authority or through a market system. It differs from state-run industry in scale and from local industry in its organization of production and distribution. The main features of this type of production are as follows:

1) This is essentially a local industry, exploiting local resources and dependent upon a local support system, which has been incorporated or embedded into a larger system of control, demand, exchange, and distribution.

2) Production may be part-time or full-time, depending on the nature of demand and the extent of external control.

3) There should be many dispersed and relatively small production centres, located with reference to ore deposits and fuel supply, as in the local type of industry.

4) The labour force is skilled and specialized; it may be engaged in either part-time or full-time production, depending on demand.

5) Its most distinctive feature is its linkage to a larger system. Its resource base is local, but control and distribution of its products involve this industry in a wider economic and political sphere.

The archaeological correlates of this type of industry should be as follows:

1) The regional distribution of sites should resemble that of local (Type II) industry: there will be many small, dispersed sites.

2) Archaeological evidence for metallurgical facilities will reflect the local base of the industry. A relatively small, local labour force will be housed in nearby settlements. There will, therefore, be no evidence of special housing or support facilities associated with mines and smelting sites. Metallurgical facilities should be small in scale.

3) The quantities of waste, by-products, and metallurgical equipment should indicate a level of production intermediate between that of Type I and Type II industries.

4) The scale of resource use (as evident in mine working, slag

heaps, deforestation, etc.) should be small, as with local industry. Patterns of exploitation, however, should suggest planned rather than opportunistic exploitation of resources.

5) The metal produced should be widely distributed. Evidence for this may, however, not be available.

### *1.3.2. Metalworking*

The main raw material necessary for manufacture in metal workshops was metal. Besides this, the process of producing metal objects was impossible without fuel, i.e. charcoal, clay and some other materials.

Metal could be supplied either as scrap, or as ingots, most often imported, of copper, tin, lead and other metals. The problem of the provenance and transportation of copper ingots in antiquity, especially in the Archaic and Classical periods, has, as G. Zimmer rightly notes[65], not been paid enough attention in Classical archaeology. The secondary use of metal played an important role in antiquity[66].

On the basis of ownership of property, workshops may be classified as: 1) private; 2) owned by the state; 3) owned by a temple. From the point of view of seasonality of activity, settled locality and distribution of production the following types of workshops may be distinguished:

1) those working without interruption in a town or large settlement, oriented to mass consumption, but including workshops fulfilling small orders. These workshops are as follows:

a) unspecialized workshops with an undifferentiated character of production that work with various materials and also engage in the repair of metal objects. They work primarily for the inhabitants of a given settlement (city, or region of a big city). The archaeological correlates of this type of industry may be as follows: they usually occupy a small area and consist of one or two rooms in a dwelling house with a furnace in a yard; there are finds of bronze and iron slag in waste dumps, as well as of waste from objects and semi-manufactured articles made of iron, bronze, lead, and of lead cramps for the repair of pottery; there is some evidence for the working of non-metallic materials, mainly bone: for instance, handles for knives;

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[65] G. Zimmer, 1990, 161.
[66] G. Zimmer, 1990, 160-161.

b) specialized workshops, e.g. armories or jewellers, or sometimes even specialized facilities: workshops for the manufacture of couches, shields, or mirrors, workshops working to order and oriented towards broad circles of customers; the output of the latter type of enterprise usually has a wider area of distribution. The labour force of such workshops varies from 5-10 people to one hundred or more, which gives an impression of the physical size of such facilities. The specialized character of their production is reflected in the more homogenous character of waste: for instance, only bronze slag, crucibles, semi-manufactured objects of bronze, finds of casting moulds or semi-manufactured articles of only one category.

Recently a classification of workshops was proposed based on ancient ceramic production which includes: workshops, nucleated workshops and factories[67]. In some studies the theory of market determinism colours the interpretation of archaeological sources. So, for example, many errors in characterising workshop specialization are rooted in the following premises: "mass production" is usually defined on the basis of the quality of artefacts; therefore, objects of a higher artistic quality are usually considered to have been manufactured in small workshops, whereas a "mass produced" output is associated with industrial areas. In some cases this occurs because of an inaccurate use of terminology: in modern economic analysis the term "mass production" has a very specific meaning, however, in older literature there was a tendency to use it to designate the rapid manufacture of a significant quantity of objects without reference to the character of the organization of production[68].

2) temporary workshops:

a) those established at important sanctuaries by wandering artisans who worked there sometimes for a few decades: a practice known already from the Geometric period. Such ateliers were probably associated with mass production, rather than with the fulfilment of specific orders—for instance, the casting of votive animal figurines for mass consumption;

b) workshops established for the manufacture of orders from a specific state (*poleis*, royal court) or temple, e.g. for the casting of a bronze statue or the production of vessels in precious metals, or workshops connected with some major building programme. The

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[67] D. Peacock, 1982, 6-11.

[68] K. Arafat, C. Morgan, 1989, 323.

most typical archaeological correlates of such workshops are pits for the casting of statues, which are usually located near to the places where the sculptures were installed: these had usually been filled in after completion of the work. All workshops known now for the casting of bronze statuary in Greece had a temporary character and were established for the casting of one single figure or, in rare clases, of a single sculptural group. The founders were usually invited to come from other cities or even regions in order to undertake the work on the spot[69];

3) "travelling" workshops:

a) such ateliers are associated with artisans who wandered from city to city in search of work. This practice had perhaps existed since the Bronze Age; in any case it is already attested at the Pan-Hellenic sanctuaries in the 8th century B.C. However, such workshops may be considered temporary only in a conditional sense because they may have existed for decades or more in the same place;

b) workshops with armies: the need for such ateliers probably arose during long campaigns associated with movement over long distances, however it is not known whether such workshops existed in the Hellenistic period and earlier: at any rate, during his Indian campaign Alexander obtained equipment for his infantry from Macedonia; Ptolemy III sent to Hippomedonos, the ruler of the Hellespont and Thrace, and Epinikes, the ruler of Maroneia, either siege engines or craftsmen for their manufacture (see below);

c) another variant of the travelling metal workshop is the atelier on board a ship. Such workshops appeared probably as early as in the Bronze Age; hypotheses about their existence in the Archaic and Hellenistic eras have been put forward as well. Archaeological evidence of such enterprises is provided by finds of ships cargoes, containing among other things metal ingots, scrap, and tools.

The terms: "centres", "workshops", "schools", and "styles" are difficult to define precisely. The tradition of naming artistic schools in Greek sculpture originates in a classic work by E. Langlotz[70], in which the appearance and evolution of artistic schools were associated with the process of city development, in terms of which a particular artistic language was established. Parallel with E.Langlotz's definition and alongside those sculptural

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[69] G. Zimmer, 1990, 156-157.

[70] E. Langlotz, 1927, 7.

schools which were characteristic of a single given centre, A. Kestner grouped art schools according to larger taxonomic units, such as Ionia or Boeotia. Since that time both these trends in definiting schools of sculpture have co-existed although sometimes in modified forms. The name of regional styles (*Landschaftsstilen*) has often been given to styles which are characteristic of one of the ethnic groups reflected in the dialects of the Greek language; in this way appeared the term: "Doric" style[71]. An important role in the formation of peculiarities of local styles was played by the underlying desire of Greek city-states for autonomy and autarchy in their cultural development; in some regions there is a noticeable tendency to differentiate sculptural schools according to artistic centres; this is demonstrated by the known rivalry between different artistic trends, for example in some centres of the North-Eastern Peloponnese. A valuable contribution to the development of art schools and styles in 7th century B.C. Greece was made by Greek tyranny because tyrants were the most important customers of artistic monuments[72].

The regional styles outlined by E. Langlotz for the Archaic period have been generally accepted by later scholars, although with changes in the attributions of some works of art[73]. In the development of Langlotz's theory distinctions between the styles of small bronze plastics have been made for the Archaic period and the "Severe Style"[74].

C. Rolley explains the appearance of local schools in Greece by the process leading to the formation of *poleis*, these being narrower and more exclusive organizations than the *ethnos*, whose unity was symbolised not by the agora and the public meeting, but by the common sanctuary. This was characteristic of Arcadia and to some extent of Boeotia as well as of the regions of North Greece, especially Thessaly and Epirus, where, correspondingly, one can trace the appearance of local styles. While the formation of schools and styles is dated by C. Rolley to the second half of the 8th century B.C., its decay is limited to the period of crises in the *poleis*. "Original" and "secondary" centres of metalworking are singled out. The colonies, according to C. Rolley, were, as a rule, with perhaps the exception of Epizephyrian Locri, represented by

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71 See, most recently, e.g. : D. Kreikenbom, 1990, 31; J. Raeder, 1993.
72 D. Kreikenbom, 1990, 31-32, Anm. 14.
73 See, e.g.: B.S. Ridgway, 1977, 283-299; D. Viviers, 1987.
74 R. Thomas, 1981; B. Barr-Sharrar, 1990.

"secondary" centres, whose style(s) were not so clearly expressed. So, for instance, in Western Greece one can only distinguish trends or tendencies in evolution, but not schools, like the Samian, or the three or four separate schools which existed on the Peloponnese[75]. K. Hitzl supposes that the definition "Corinthian" is limited by given geographical borders "ohne eindeutige stilistische Anhaltspunkte"[76].

In the definition of the term "workshop" in Classical archaeology ambiguity and confusion prevail. "Workshop", regardless of the medium, seems most often to describe the following:

1) A single room or building in which work of all kinds is carried out.

2) The products of a group of persons who are presumed to have worked together at one location.

3) Products which reflect the style of a master, such as "from the workshop of x,y-potter/painter". The differentiation between 2. and 3. is very subtle and extremely difficult to define in individual cases.

Several attempts to distinguish workshops on the basis of stylistic analyses have been undertaken. So, for instance, H.-V. Herrmann in discussing Geometric bronze plastics indulges in an art-historical digression which he bases upon evidence from excavated contexts[77]. Defining the term "sculptural workshop", B.S. Ridgway states that it means an individual master, who worked with his sons and several apprentices, the latter doing the routine work; on this view, the sculptural atelier was more primitive than a Renaissance bottega. Later on, the apprentices may have established their own workshops or inherited those of their teachers[78]. Such ateliers may have been of the "father-son" type. In solving problems of attribution, a corresponding problem arises of defining the hands of the "master", his workers and his apprentices (*Meister-Werkstattmitarbeiter-Werkstattgehilfe*)[79].

An interesting attempt to classify the terms "workshop", "studio", "school", "manufacture" has been made by W. Rudolph[80]. In his view, "workshop" should be restricted to the discussion and

75 C. Rolley, 1986a, 140; *Un secolo di ricerche in Magna Grecia*, 1990, 268 (C. Rolley).
76 K. Hitzl, 1982, 10f.
77 H.-V. Herrmann, 1964.
78 B.S. Ridgway, 1977, 292, 299.
79 H.-J. Schalles, 1985, 77 ff.
80 W. Rudolph, 1988, 528-533.

analysis of materials where the precise physical location of their contemporary production is known. Local generic terms, such as Athens/Attic or Corinth/Corinthian would not be sufficient to define a workshop: you would have to identify a specific building at a given site. Such use of "workshop", incidentally, would apply to all categories of objects, whereas the term in the true sense of its original meaning is applicable in historical, economic and technical studies. An example of a true workshop is an excavated paradigm such as the workshop of the sculptor Phidias in Olympia. "Workshop", therefore, should be a term used in the discussion of archaeological materials or at least to those closely related to contexted finds.

The term "studio" is closely associated with the definition "master", i.e. an individual artist who has been recognized or defined by means of stylistic analysis. The objects from a studio share sufficient traits to intimate that a number of artisans—in any case more than one—worked closely together, sharing one source of style to a smaller or larger degree. As a consequence, objects from a studio reflect a common aesthetic denominator. The term "studio" was chosen because of the general perception that it seems to connote products deriving from the artistic activity of more than one person.

The term "school" defines a grouping below the level of studio, based upon a smaller degree of communality of stylistic traits. The basic requirement for a school is that its products share a number of principles, normally of an artistic nature. The term "school" is best applied to works of figurative art, such as painted vases or sculptures since a certain level of stylistic sophistication is required. For less intricate items such as plain vessels or architectural terracottas the term "manufacture" can be employed with greater success, according to W. Rudolf.

The latter term describes objects which share characteristics of technique and material as well as having a basic aesthetic likeness. In addition, a third factor in determining manufacture may, but need not, be distribution over a wider geographical area. "Manufacture" organizes materials at an initial level of analysis normally using typology as its principal tool of investigation.

### *1.4. Models of Distribution*

K. Polanyi has singled out three main types of trade characteristic of the ancient world: gift exchange, administered or treaty trade,

and market trade. Recently his theoretical studies have formed the basis for models of the relations between Classical and barbarian societies in B. Cunliffe's monograph. Cunliffe employs the term "gateway community", to indicate a society located on the natural trade routes connecting territories rich in mineral or agricultural resources, and defines the inner structure of such communities, whose hinterland was connected to the periphery by various means[81]. At the same time, the categories of distribution worked out for ancient societies by K. Polanyi—reciprocity: exchange, or interchange of goods between two parties without monetary equivalent, and redistribution, i.e. the delegation of goods to a central authority and their circulation via a central administration—are hardly appropriate to concrete analyses of ancient Greek economies[82].

There are various classifications of commodities in modern literature, for example, according to the level of their utility, as was done by K. Hart, who distinguishes 10 different stages of evolution, each subsequent step including the previous one: from the 1st stage: a thing produced for use, to 2. a thing produced by one individual for another; to 3. something that is the product a division of labour; to 4. a thing circulated by means of exchange; to 5. a thing exchanged through market mechanisms with a determined value. However, the model he proposes does not exhaust the full variety of forms for the distribution of artefacts. By strict definition, booty and tribute would seem to be excluded at phase 4. It is also the case that since most objects distributed as booty or tribute had already passed through stages one to three, they had been commodities in the past, and so the entire history, or "biography" of an object must be taken into consideration, not just the single "moment" of appropriation[83].

In what ways did the distribution of metal objects take place? The following models were possible: 1) as the result of trade, including gift exchange; 2) as diplomatic gifts; 3) as votive offerings to the sanctuaries; 4) as personal belongings.

Votive offerings at the Greek and barbarian sanctuaries require special discussion. It seems that the following types of provenance can be proposed for finds from Greek sanctuaries: a) *ex-voto,*

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[81] B. Cunliffe, 1988, 4-6.
[82] See: T.J. Figueira, 1984, 18-21.
[83] See: I.J. Winter, 1988, 209.

manufactured in a workshop at another Greek city; b) the product of a non-Greek workshop (at Eastern centres, Etruria, and north of the Balkan peninsula). The motives behind the making of offerings should also be taken into consideration: a) an offering by a Greek who had returned from the periphery of the oikumene or from another Greek city, which is sometimes defined as a "souvenir"; b) the dedication of an object of war booty, captured in the course of wars with other cities or states, including barbarian ones; c) barbarian *ex-votos* at Greek sanctuaries of various levels, offerings by: 1) private persons; 2) at the state level (by a king, tyrant, *poleis* etc.).

I. Kilian-Dirlmeier analyzes the composition of votive offerings of the 8th-7th centuries B.C. in four Greek sanctuaries and defines three chief factors which determined the offering: 1) cult rituals and practice; 2) geographical situation; 3) economic and political situations in the region, including those in the city-state concerned:

1) there was no special range of votives associated with cult which was characteristic of any one sanctuary of the Late Geometric—Early Archaic period: dedications of clothes, amulets, ornaments, figurines, arms and bronze vessels were common everywhere. The differentiation of votive practices, however, is reflected in a preference for some categories of objects, for example, for amulets in Perachora, or bronze cauldrons and arms at Olympia;

2) neither of the sanctuaries analyzed was characterised by a growth in the quantity of imported votives inverse to the distance from their centres of manufacture; the prevalence of Macedonian and Balkan artefacts in Pherae and, on the other hand, of Eastern objects in Samos, may be explained rather by the location of the sanctuary and of the city-state, to which it belonged in particular, in relation to existing trade routes;

3) expensive votives may be explained, as in Olympia or in Delphi, by the international importance of these sanctuaries. Along with luxury objects they prove, as is shown by finds from the Samian Heraion, visits by a certain class of dedicators, outsiders primarily from trading *metropoleis*. Only their low value distinguishes a series of non-Greek votives dedicated at other sanctuaries. Their wide distribution shows that they were souvenirs offered by Greeks and points to a general international acknowledgement not just of considerable cult centres. The imported votives evi-

dently prove the close relations of the Greek world with neighbouring areas as well as with more distant zones of contact[84].

Due to their high value, metals—especially precious metals—were often redistributed in the form of raw material or as coins or objects etc. E. Will accordingly distinguishes two ways of conversion in which precious metals were converted into coins: 1) mintage by treasuries; 2) the striking and over-striking of existing coins, and discusses the economic and political premises of these activities[85].

It seems necessary to distinguish two models of "redistribution" over and above the models of normal distribution: 1) as war booty; 2) "technological redistribution".

The first model was a universal tool of redistribution in antiquity. The peculiarity of this form of redistribution was originally inherent in it: goods, coins or the metal in ingots were not manufactured but captured: later on they may follow some other way of redistribution.

A less general form of redistribution follows a model which I conventionally call as "technological redistribution", i.e. remelting, rehammering: operations, which changed the original qualities or functions of the object. Thus, captured ingots of metal may have been used for coinage, melted down for statues or hammered into arms. During these operations objects of one category are refashioned into those of another: sculpture into armour, tools into weapons etc.

"Technological redistribution" took place not only in the context of war loot, i.e. it did not always have the character of "secondary distribution".

The reasons for "technological redistribution" may have been the wearing down or breakage of artefacts; thus, ornaments, tools, arms and armour were remelted or rehammered; defaced or full-weight coins with high percentages of precious metals were remelted or overstruck. Such operations could be carried out in small private workshops, which served the needs of a city (settlement), in a state (royal) jewelry shop, in armoury workshops, or shipyards, as well as in the field in military workshops, or in ateliers at sanctuaries.

Another reason for "technological redistribution" was an "economy of need", when, for instance, during military operations state

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84 I. Kilian-Dirlmeier, 1985, 243-244.

85 E. Will, 1975, 99, 102.

(royal) or temple treasure-stores in the form of ingots, statues, and vessels of precious metals could have been melted down to provide coinage.

"Non-economic" reasons for "technological redistribution" primarily involved the desire for war booty: in such cases the decisive motives were political propaganda, religious belief, personal ambitions etc.

Besides "technological redistribution" there existed in antiquity a practice of "irreversible depositing", when some objects of special value (even not economic, but religious) were intentionally hidden. It seems that this practice included the depositing of bronze sculptures[86].

A certain relation existed between the category of an object and the model of its distribution.

C. Rolley states that bronze statues of the 6th-4th century B.C. in contrast to later pieces have precise functions: when a statue was installed in a sanctuary, it could depict the deity to whom the sanctuary was dedicated, and was a public offering made on special occasion. Another group of sculptures was offered at the largest sanctuaries by certain city-states as an expression of gratitude to the deity on the occasion of a victory or of some solemn event, in fact serving the reputation of the city which had dedicated the statue. That was also a reason for the installation of statues at agoras in increasing quantities after the Classical period .

Small bronze objects also had various functions. First of all, they were articles of everyday use in the home or on the battlefield. Secondly, they served as votive offerings at the sanctuaries. Thirdly, these artefacts could be included in burial inventories. The borders between these groups are certainly rather conventional. Thus, an object in everyday use could be offered at a sanctuary, and a bronze vessel, as was often the case with hydriai in the 4th century B.C., could be used as a burial urn. Nevertheless, there is a more precise correlation for certain categories of objects. For example, bronze statuettes were originally considered to be votives; judging by their dedication inscriptions they were offered by private persons. With the exception of rare bronze statuettes (from the periphery of the Greek world) these pieces were not put into graves; they served as household decoration no earlier than the Hellenistic period due to a change in taste[87].

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[86] See M. Donderer, 1992.
[87] C. Rolley, 1986a, 30-33.

## CHAPTER TWO

# THE ROLE OF METALS IN THE PERIOD OF GREEK COLONIZATION

### *2.1. Mining according to Ancient Written Sources*

In general works devoted to mining and metallurgy in the ancient world[1], there has been practically no attempt to show, at which historical periods the Greeks exploited this or that ore deposit. Except on rare occasions, when ancient sources preserve evidence of the chronology of the exploitation of mines, the picture remains unclear, as for example in the monographs by R.J. Forbes or J.F. Healy. Written sources combined with archaeological data prove in their opinion that in the Archaic period copper and iron were mined on Euboea. Perhaps, some copper was smelted from ores in Macedonia, the Argolid, at Delos, or in Asia Minor, e.g. at Cysthene on the coast opposite Samos. Lead and silver ores were known in Laurion, and on the island of Siphnos. Iron ores were mined in Boeotia, Laconia, on the islands of the Aegean Sea, and in Asia Minor. Important sources of gold were available in the mines of Macedonia and Thrace, of Siphnos and Thasos; alluvial gold was exploited by the Lydians in the region of Mt. Tmolus and in the Pactolus river. Silver was also mined in Macedonia and Thrace[2].

### *2.2. Mining according to Archaeological and Archaeometallurgical Studies*

New data about the exploitation of ore deposits in the Archaic period has been produced in recent years. For example, in 1975-1977 the Max Planck Institute in cooperation with other several institutions led the investigation of silver mines in Asia Minor, the

[1] See, for example: R.J. Forbes, 1963, 139 ff.; J. Ramin, 1977; K.D. White, 1984, 113 ff.

[2] R.J. Forbes, 1950, 198 ff.; J.F. Healy, 1978, 46, 53, 57 f., 61 f.; see also: J. Ramin, 1977, 201 f.; R. Pleiner, 1969.

Balkan peninsula and the islands of the Aegean Sea. Besides the deposits mentioned above it was proved that there had been ancient exploitation of mines in the region of Stageira in the north of Greece, as well as on the island of Thasos[3]. Studies in 1975 and 1983 of the Troad revealed many mines exploited in ancient times, including Classical antiquity (fig. 1-3, 1). One of them, in Balya, was in use as far back as in the Archaic period[4].

Analyses of the lead isotopes Pb-206, Pb-207, Pb-208 make it possible to determine the provenance of ore samples. This possibility is based on the fact that, in many instances, leads from different ore deposits have distinctly different isotopic compositions[5]. However, this technique has its limitations, while certain ore deposits with lead exist which seem to be isotopically indistinguishable. Several scholars have recently expressed scepticism about the feasibility of solving problems of provenance with the help of this method, although they recognize it as the only available approach to the problem[6]. Recently in the pages of the "Archaeometry" the results were published of a statistical evaluation of the lead isotope data accumulated to date from Laurion, Cyprus, Aegean islands and Anatolia, these being followed by a discussion. Some scholars, representing primarily the Oxford research group (N.H. Gale, Z.A. Stos-Gale) and the Smithsonian Institute (E.V. Sayre, K.A. Yener, E.C. Joel) feel encouraged about the application of stable lead isotope measurements to provenance studies and state that the overlap between the various source fields is relatively limited and for such important deposit as Laurion only one contaminating source has yet been found. Out of about 100 ore bodies so characterized there are only two cases where the lead isotope data overlap seriously. Others, particularly the German research group (E. Pernicka, E. Begemann etc.) and the research group of the University of Bradford (P. Budd, D. Gale, A.M. Pollard), maintain that to characterizing an ore source for use in provenance studies of archaeological metal objects much more geological, mineralogical, and geochemical information is needed than was hitherto considered necessary[7]. I do not think that a critical evaluation of lead isotope data ex-

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[3] W. Gentner et al., 1978, 275-278.

[4] E. Pernicka et al., 1984, 542.

[5] See, e.g. N.H. Gale, 1989a; Z.A. Stos-Gale, C.F. Macdonald, 1991.

[6] See, e.g. E. Pernicka et al., 1990, 278f.

[7] E.V. Sayre et al., 1992; 1993; P. Budd et al., 1993; 1993a; M.N. Leese, 1992; N.H. Gale, Z.A. Stos-Gale, 1992; 1993; E. Pernicka, 1992; 1993.

cludes the possibility of using conclusions obtained in the present study, moreover the multidisciplinary approach allows us to check whether the results of lead isotope provenance studies, given that these are treated with caution, show correlations with archaeological and historical observations.

Analyses of the lead isotopes Pb-206, Pb-207, Pb-208 demonstrate that as long ago as in the 3rd-2nd millenniums B.C. lead and silver articles in Greece proper and in the Aegean Islands were manufactured from metal extracted from two main deposits—Laurion and the island of Siphnos[8]. At present a total of 70 pre-Classical artefacts are known with clearly significant probabilities of being related to the Laurion ores: of these 62 were found at sites on mainland Greece and the Aegean islands, six were found in Anatolia, two come from Egypt and one from a Mesopotamian site[9].

Though bronze and lead objects were produced in Cyprus in the Bronze Age of local ore, their quantity was not significant[10]. Given the near absence of lead ores on Cyprus one would expect that the lead of artefacts from Cyprus came from some more distant source, probably from Samos[11]. The view that the Laurion mines had never been exploited before the second half of the 6th century B.C. was defended by É. Ardaillon and is still prevalent today[12]. However, archaeological study of the mine workings at Thorikos has revealed ceramics, dating from the Bronze Age till the Archaic period[13]. Besides these, the remains were found of installations for ore washing, dating to the 9th century B.C.[14]. The find allows us to assume that mining took place at Laurion in the 8-7th centuries B.C. as well, although it is difficult to estimate the production level. Modern investigations in Laurion show that not only silver and lead were extracted here, but copper as well. Moreover in the Bronze Age Laurion along with Cyprus was one of the main sources of copper not only for Greece, but also for

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[8] See, e.g.: N.H. Gale, 1980; N.H. Gale, Z.A. Stos-Gale, 1981; 1981a; 1982; V. Karageorghis, N.H. Gale, Z.A. Stos-Gale, 1983; N.H. Gale, Z.A. Stos-Gale, J.L. Davies, 1984; *IAMS Newsletter* 6 (1984), 6 f.

[9] E.V. Sayre et al., 1992, 85, 100, 104-105.

[10] Z.A. Stos-Gale, 1985, 71.

[11] E.V. Sayre et al., 1992, 87.

[12] É. Ardaillon, 1897, 134-136; R.J. Forbes, 1950, 198; S. Lauffer, 1980, 4; G. Weisgerber, G. Heinrich, 1983, 196; H. Kalcyk, 1982, 99-106; 1983, 15 ff.

[13] J.E. Jones, 1982, 176.

[14] R.J. Hopper, 1968, 293 ff.; 1979, 170; J.N. Coldstream, 1977, 70, 311.

the islands of the Aegean Sea, and even for Crete (fig. 3, 2)[15]. The volume of metal extraction in Laurion is rather difficult to estimate, nevertheless, some data suggest that in the 8th-7th centuries B.C. it was quite high: judging by analyses of lead isotopes in Egyptian bronzes of the 25th-27th dynasties, the lead used in their manufacture, especially of articles dating from the 25th dynasty, i.e. ca. 767-656 B.C., originated from the mines of Laurion[16]. Meanwhile in the 6th century B.C. there was probably a reduction of mining at Laurion. Anyhow, lead isotope analysis has shown that there is no trace of Laurion silver in early Attic coins dating to before ca. 530-520 B.C., and it is never found in substantial quantities in the metal of Attic coins, dating to before ca. 500 B.C. The silver used as coin metal in mintage of the earliest Athenian coins, the so-called "*Wappenmünzen*", originated from various metal sources, one of which was in Northern Greece[17]. H. Montgomery explains this fact by a passage from Herodotus (III. 63) that Strymon became an important source of Peisistratid income[18]. Peisistratos had probably stayed in the Pangaeus region during his second period of exile in 556-546 B.C.[19], not with a view of colonizing the area, but with the aim to collecting the means for his return to Athens[20]. It may have been that, the main source of silver for Athens in the period between the middle and the late 6th century B.C. was the Thracian mines. J.F. Healy supposes that it was the loss of the Macedonian and Thracian mines captured by the Persians in 512 B.C., which compelled the Athenians to start the exploitation of Laurion[21]. Gold and silver mines on Siphnos were mentioned several times by Herodotus (III. 57). This ancient historian pointed out that the Siphnians were the richest among all the inhabitants of the islands, and they attained this prosperity in the time of Polycrates of Samos. As is stated by Pausanius (X.8. XI.2), the Siphnian mines were exhausted when the Siphnians failed to send donations to Delphi. Thus, judging from the ancient tradition, the island was rich in precious metals, the sources of which had been exhausted perhaps at about 516

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[15] N.H. Gale, Z.A. Stos-Gale, 1982a; 1984; N.H. Gale, Z.A. Stos-Gale, J.L. Davies, 1984, 400; C. Aubert, 1988; N.H. Gale, 1989.

[16] S.J. Fleming, 1982, 67-69.

[17] N.H. Gale, 1980, 28, 33-43; J.H. Kroll, N.M. Waggoner, 1984, 338; H. Montgomery, 1984, 126-127.

[18] H. Montgomery, 1984, 127.

[19] H. Berve, 1967, 47-63.

[20] D. Tzavellas, 1983, 164.

[21] J.F. Healy, 1978, 53.

B.C.. What data can modern studies add? The extraction of silver and lead there began in the early 3rd millennium B.C.. Mine workings have been found at five different places on the island. Thermoluminescent analysis of ceramic fragments from the debris of mine N 2 in Aios Sostis has produced the following dates: 750+/-190 B.C.; 660 and 530 B.C.; slag analysis gives 810, 750 and 570 B.C.. In the underlying stratum were found fragments of pottery and charcoal, C-14 thermoluminescent analysis of which has produced dates ranging from 2970 to 2590 B.C.[22].

Among the gold mines mentioned by Herodotus, were those situated on Thasos (fig. 5). Telling about the income of the island, he wrote that the gold mines at Skaptesyle had normally given 80 talents to the Thasians, whereas the mines on the island itself gave rather less (VI. 46). He states that the most remarkable mines were those established by the Phoenicians, when they settled there under the guidance of Thasos. These Phoenician mines were situated between the places called Enyra and Kenyra opposite to Samothrace (VI. 47). B. Holtzmann, in analyzing the above passage from Herodotus, came to the conclusion that the Phoenician mines had never been gold mines[23], thus contrasting the gold mines at Skaptesyle to the mines on the western part of the island. The same view was defended by A. Müller and some other scholars, who considered that the mines of Kenyra were specially mentioned by Herodotus neither because of the fact that precious metals were extracted here (they were also mined in the other parts of the island) nor because of the high income they brought in; "the father of History" was primarily attracted by the antiquity of the mines[24]. The most ancient mines were found on the Acropolis of Thasos in 1978-79. Judging by pottery finds, they were in use from the late 6th century B.C.[25]. Mines were also found on the east coast of the island between the gulfs of Potamia (perhaps, ancient Enyra) and Kenyra. In ore samples from the 450 metre long galleries of the mines on the Acropolis of Thasos (fig. 6), gold was found, and indeed in one of the samples in a

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[22] G.A. Wagner, G. Weisgerber, 1979; N.H. Gale, 1980, 183-192; G.A. Wagner, 1980, 247, Abb.8; G. Heinrich, 1981; *IAMS Newsletter* 4 (1983), 3; 6 (1984), 6; *Silber, Blei und Gold auf Sifnos*, 1985, 205.

[23] B. Holtzmann, 1979. About archaeometallurgical attempt to locate Skaptesyle see: E. Photos et al., 1989. S. Morris considers that iron from hematite rich sands probably attracted the Phoenicians. See: S. Morris, 1992, 143-145.

[24] A. Müller, 1979; J. Des Courtils, T. Koželj, A. Müller, 1982, 417.

[25] T. Koželj, A. Müller, 1979, 658.

substantial quantity, enough to conclude that neither copper nor iron, as was earlier supposed, had been mined there, but gold. High concentrations of gold have been found in ore samples from the mines of the eastern coast, identified with those seen by Herodotus[26]. Recently an idea was put forward that considerable layers of iron slag, which can be dated to the 7th century B.C. and were excavated under the temple of Artemis on the Acropolis of Thasos, may have been associated with gold extraction[27]. To be precise, the excavation report stated that the slag was found in a layer with pottery dated to the second half of the 7th—first half of the 6th century B.C.[28]. Some scholars suppose that in the 7th-6th centuries B.C. iron was smelted on Thasos from the local hematites and maintain that the smelting of metals from local ores on Thasos even began in the 9th century B.C.[29].

Lead isotope analysis of nine lead objects found on Thasos in layers of the mid-6th-mid-5th century B.C. has shown that the ore smelted to obtain this metal was of local origin; a study of 31 silver coins of the Thasian mint of the last quarter of the 6th—early 5th century B.C. has revealed that only half of them were struck from silver originating on the island and *pereia*; 3 coins were minted from Laurion silver, and 5 from silver mined on Siphnos[30].

In the Archaic period silver-lead ore deposits were also exploited at Chalcidike and on the south part of Euboea, which probably served as a source of coin metal for neighbouring Acanthus, Stageira and Terona[31], and on Lesbos, where in one of the mine galleries there were found 6th century B.C. pottery fragments[32].

Near the village of Alihoka in the mining region of Bolkardağ in the south-east of Turkey there is an inscription of the local king Tarhunzas, a vassal of the king of Tuvana, Varpalavas (738-710 B.C. ); not far from here were found the remains of 7 furnaces, silver-lead slag heaps with fragments of Iron Age pottery[33].

During excavations of an Early Iron Age settlement located on

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[26] G.A. Wagner et al., 1979, 613; 1981, 263; T. Koželj, A. Müller, 1980, 716 suiv.; M.E. Caskey, 1981, 460.

[27] C. Koukouli-Chrysanthaki, 1988, 176, 178, Anm. 33.

[28] J.-J. Maffre, F. Salviat, 1980, 729-730.

[29] E. Photos et al., 1988, 45-46.

[30] N.H. Gale et al., 1988.

[31] G.A. Wagner et al., 1986; N.H. Gale et al., 1988, 219-221.

[32] E. Pernicka, 1987, 649.

[33] K.A. Yener, H. Özbal, 1986, 316.

Iron Age pottery finds from the sites of the Bolkardağ mining district in

the Sithonia peninsula in Thessaly were found an unusually large number of pebble pounder grinders as well as fragments of a soapstone mould and lumps of burnt clay. The metallurgical and metalworking activity at the site may be associated with two currently disused mines within 5 kms of it, which are the only ore outcrops in the sub-peninsula; one has deposits of gallena-copper and the other of galena-iron pyrites[34].

The presence of Archaic mining on Cyprus is proved by C-14 analysis of charcoal from the mines of Tamassos, which have given the following results: 685-660+/-110 B.C.[35], as well as by signs of mining activity in the region of Marion[36].

Large-scale mining and smelting have been shown by the recent work of the Deutsches Bergbaumuseum, Bochum, to have taken place in the 8th-5th centuries B.C. in the copper mines of Edome (modern Jordan), that which is probably reflected in the "Book of Edome". At that time the Egyptian mines of the Timna valley were on the decline[37].

Returning to the survey of mining and metallurgical activity in 8th-6th c. B.C. Greece, I can state that the mining and extraction of gold and electrum is confirmed by documentary sources. There is also no doubt that the Greeks produced silver and lead objects from the ores of Siphnos and Laurion: for the period of the second half of the 6th century B.C. this shown by the results of analyses of the Greek silver coins from 14 centres of mintage found in the Asyut hoard in Egypt. A third major silver ore deposit, characterized by high natural additions of gold, bismuth and tin, may have been located either in Macedonia or in Lydia, although the exact geographical position of this silver source for early Greek coinage has not yet been determined[38]. The great number of bronze objects—of a variety of types—and the relatively large number of known bronze workshops of the 8th-6th

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Anatolia are abundant, compared with lack of evidence for the Bronze Age. See: B. Aksoy, 1991, 13.

[34] E.B. French, 1993, 54, fig. 37.

[35] H.-G. Buchholz, 1978, 167.

[36] P. Raber, 1987, 305.

[37] *IAMS Newsletter* 13 (1988), 6.

[38] See: N.H. Gale et al., 1980, 46-49. The study of the gold melting remains in Sardis, dated to 620-550 B.C., has shown, that Lydian founders used the cementation technique for partition of gold and silver from refined electrum. See: J.C. Waldbaum, 1983, 7; 1987, 38-39; cf. R.J. Forbes, 1950, 158 f. It is also possible that silver from Laurion was used even for the mintage of Croesus. In any case, the change of silver sources used in Anatolia occurred somewhat between the 12th and 7th centuries B.C.. See: U. Zwicker, 1986, 163-164.

centuries B.C. most probably demonstrate the use of raw materials from Greece itself. This is shown indirectly by the wide distribution of the Laurion copper ores in as early as the Bronze Age. Therefore, I can not agree with the view that ancient Greece was not a copper-producing country and that the small local deposits would seem to have been exhausted at a very early date[39]. A much more complicated task was the reception of tin, the main alloying component for bronzes. Periodical news reports of finds of ancient tin deposits in Greece and Asia Minor have usually not been confirmed. This means that there is practically no doubt that the Greeks imported tin[40]. Only recently deposits of stanine were found in the Taurus mountains. Ancient settlements are known in this region with furnaces, dating from various periods[41]. Many of the geological and analytical details connected with the claims for the existence of tin in the Taurus region have been recently discussed in a debate in the pages of the "Journal of Mediterranean Archaeology" and the "American Journal of Archaeology". Some scholars maintain that the production of tin metal by the reduction firing of tin oxide already took place in the 3rd millennium B.C., to judge by finds from the Göltepe site in south-central Turkey., or even at ca. 3000 B.C., to judge by finds from its tin mine Kestel[42]. The other think that evidence to support the hypothesis that tin came from the Taurus region does not come readily to mind. O.Belli has recently suggested that between the 2nd millennium B.C. and the 11th century A.D. tin was imported into Anatolia from the East, most probably from Afghanistan and even from Malaysia. D.Muhly reminds us of the fact that a very well-known trade route, documented in numerous Old Assyrian cuneiform texts, dated to the early 2nd millennium B.C., recorded the passing through the Taurus mountains of hundreds of donkey caravans bringing tin from a distant eastern source into Central Anatolia. At any rate, from the analytical evidence from Poliochni, Troy and Kastri on Syros it is clear that at some time in the second half of the 3rd millennium B.C. a major rearrangement took

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[39] See, e.g. R.J. Forbes, 1950, 303 f.; cf., e.g., S. Morris, 1992, 131 ff. maintaining that mineral resources of the Aegean were even the chief catalyst of the Phoenician contacts with Greeks.

[40] S. Benton, 1964; J.D. Muhly, 1973; 1976; 1985, 277f., 290 f.; K. Branigan, 1974, 64-66; J.A. Charles, 1975; T.A. Wertime, 1977, 4; P. De Jesus, 1980, 57-60, 396, map N 20; J.C. Waldbaum, 1983, 5 f.; R.D. Penhallurick, 1986.

[41] K.A. Yener, 1986; K.A. Yener, H. Özbal, 1987.

[42] See, e.g. K.A. Yener, M. Goodway, 1992; K.A. Yener, P.B. Vandiver, 1993; 1993a; L. Willies, 1992; 1993.

place in the supply of metal in the Aegean. The major part at least of the tin bronzes came from outside the region[43]. Thus, whether tin was smelted there and when, remains an open question. Although iron forges are known from the period under discussion, the question of whether iron ore was imported into Greece from the Near East has been given special consideration by A.M. Snodgrass, who based his conclusions on the results of G.J. Varoufakis' analyses of spearheads from Mycenae[44]. However, the results of new investigations conducted by G.J. Varoufakis partly overturn his early hypotheses. Metal analysis of 19 iron tripods of the 9th—early 7th century B.C. from Olympia has shown that some of them were manufactured from local ores, including ores from deposits from Crete and Laconia. This conclusion gives him reason to suppose that at least part of the iron objects of this period was produced from local ores, which surely does not exclude the possibility that greater or lesser quantities of iron were imported into Greece[45].

The remains of ancient mines are also known from areas colonized by the Greeks. So, for example, iron, copper and silver-bearing ores were extracted in Etruria not far from the colonies founded by the Greeks. Interesting data has been obtained from excavations at Poggio Civitate, an Etruscan site of the 8th-6th centuries B.C., located 40 km from the coast opposite Elba: 1 km from the settlement there is a deposit of copper ore, whereas there are no traces of iron ore in the vicinity. The nearest deposits of iron ore are situated on Elba and, according to some scholars, the iron ore of Elba was unknown to the Etruscans before the mid-6th century B.C. So, how were the iron objects found in Poggio Civitate made? Analysis of slag found there gives grounds to suppose that iron ore from Elba was transported to the

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[43] See, e.g., O. Belli, 1991; M.E. Hall, S.R. Steadman, 1991; E. Pernicka et al., 1990, 290-291; 1992; J.D. Muhly, 1993.

[44] G.J. Varoufakis, 1970; A.M. Snodgrass, 1980, 354. See in general about iron production in ancient Greece and Near East, e.g.: R.J. Forbes, 1950, 378ff., R. Pleiner, 1969. For instance, R.J. Forbes maintained the following: "The Greeks were never prominent in metallurgy and imported their iron mostly in semi-finished condition. It is doubtful whether the Greeks of the epic were very familiar with its production, but the generation of Hesiod already possessed a considerable knowledge of "the softening of iron in glowing mountain fires" (Theogony 862-866). The earliest exploitation of ore deposits after 1000 B.C. was probably in the islands rich in ores such as Samothrake and Euboea and in Sparta in Boeotia" (R.J. Forbes, 1950, 458; cf., however on p. 459: "Laconia later famous for its steel may not have begun industrial production before 550 B.C.".

[45] G.J. Varoufakis, 1979; 1982, 318 f.

mainland only after the late 6th century B.C. For example, at Populonia the iron slag debris overlay the 7th century B.C. necropolis[46]. In a letter dated 1.06.1988 A. Coretti, who studied the slag debris of Elba, kindly informed me that there is no archaeological data that proves the presence of mining from the 8th century B.C., although some scholars, including Coretti himself, consider that iron ore was not only extracted here, but was distributed to Pithekoussai and, beyond, to the region of modern Pisa, Genua, and the river Arno. Nevertheless, it is unbelievable that no traces of such large-scale early mining activity have been preserved. Of 110 slag heaps studied by A. Coretti more than 30 were found to contain pottery sherds dating either to the Hellenistic period or to the Middle Ages (12th-14th centuries). Combining the data of geological studies of the mines of Central Italy and the results of metallographical and archaeological investigations, P.G. Warden has convincingly shown that prior to the mid-8th century B.C. ore deposits in the region had been mined sporadically, mining activity having a seasonal character. The systematic extraction of copper started from the middle of the 8th century B.C., that of iron after the mid-6th century B.C.[47]. At present there is only one piece of analytical evidence showing the importation of Etrurian metals in the period between the mid-8th and the mid-7th century B.C.: isotope analysis of a lead figurine from an Egyptian temple of the 25th dynasty has shown that the correlation of lead isotopes is extremely similar to that of some Etruscan bronzes from Vetulonia and to lead from the mines at Piombino[48].

Remains of silver and copper mining dating to the 8th-6th centuries B.C. have been found quite recently at Rio Tinto, Iberia. The production bears signs of domestic-scale activity with a modest output, which cannot be compared with the activity of the numerous businesses of the Roman period. It is noteworthy that archaeological evidence, including the clearly Eastern character of methods of silver extraction, proves that mining was conducted by the Phoenicians[49]. The "Huelva" project, carried out by the Institute of Archaeo-Metallurgical Studies, has provided an opportunity to complete the picture on the basis of a multidisciplinar

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[46] P.G. Warden et al., 1982; 1991.

[47] P.G. Warden, 1984; see also A. Zifferero, 1991, 218 f., 223, 229-231; G.E. Markoe, 1992, 71-73.

[48] S. Fleming, 1982, 68.

[49] A. Blanco, J.-M. Luzon, 1969.

study of the sources[50]. Production remains from the period discussed were found mainly in the copper mines. The remains of silver smelting were revealed in 1979-80 at Corte Lago. Noteworthy is that pottery fragments found in slag heaps contain sherds of local hand-made ceramics (81%) and of Phoenician amphoras. Study of the ceramic material and the slag from Corte Lago gave some scholars reason to suggest that there had been no "foreign technological colonization",—i.e. while mining activity was a local Tartessian enterprise, trade in metals was conducted by the Phoenicians[51]. Unlike other workshops that have been excavated, such as that at San Bartolome de Almonte, Monte Romero is located in close proximity to the mine and shows all the various stages in the process, from the ore to cupellation. The sophisticated process established by archaeo-metallurgical investigation shows that the people working in the 7th century B.C. workshop of Monte Romero were competent metallurgists who were able to process even highly complex ores to produce silver[52].

Thermoluminescent analysis of silver slag from Calle Pulos, Huelva, has shown that it is datable to 401+/-280 B.C., which is fairly close to the preliminary dating of 800-700 B.C.[53].

Among other reasons for the foundation of Apollonia Pontica in the western coast of the Black Sea by its mother city Miletus, the search for copper from the Strandzha mines has been considered[54]. A study of the Central Strandzha mines in 1975-81 has shown that besides materials dating to the Aeneolithic period and the Bronze Age, Thracian ceramics of the 5th-3rd centuries B.C. and Hellenistic material were found[55]. Similar results have been produced by joint Soviet-Bulgarian expeditions in 1971-72 and 1974. The settlements located near the mines are dated either to the 4th-2nd millennia B.C., or to the Hellenistic or Early Medieval periods[56]. Also dated to the Hellenistic period are the copper ingots found in the sea near Achtopolis[57].

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50 B. Rothenberg, A. Blanco-Freijero, 1981; see also my review: M.Yu. Treister, 1987, 233-235.

51 B. Rothenberg, A. Blanco-Freijero, 1981, 171-173; B. Rothenberg et al., 1986. See in general about the Phoenician system of silver extraction and trade: M.-E.Aubet, 1993, 236-241.

52 V. Kassianidou, 1992.

53 G.W. Carriveau, 1974.

54 See, e.g.: H. Danov, 1969, 16; V. Velkov, 1988.

55 E. Teoklieva, P. Balabanov, 1981, 18-22.

56 A. Raduncheva, E.N. Chernykh, 1978, 322 ff.

57 V. Velkov, 1988.

A.S. Ostroverkhov, analyzing the remains of smithies in the Dnieper-Bug estuaries, came to the following conclusion. The iron ores found in the Yagorlyk settlement are magnetitic quartzite, deposits of which are located in the Krivoj Rog basin and in Korsak-Mogila in the Northern Taurid. The finds are shaped as rectangular bars, which according to A.S. Ostroverkhov, prove that raw materials were specially prepared for long-distance transportation[58]. Ostroverkhov also considers that the complexes associated with iron processing and found on the island of Berezan were intended for the enrichment of the hematite sands of the Dnieper and Bug rivers from the crystalline massif of the mainland[59]. Later on, A.S. Ostroverkhov's hypotheses came under criticism, so at present the question of whether iron ore was locally extracted at the Yagorlyk settlement is still open[60].

Mineralogical study of samples of iron ore and slag from excavations at Thorikos near Novorossijsk in the North Pontic region has shown that the ores belong to sedimentary layers of a Cimmerian date and that their chemical composition is close to that of Kerch iron ores, although their texture is different. This may argue in a favour of looking at the western coast of the Caucasus as the source of ore found in Thorikos[61]. Examples of local Kerch ore have been found several times during excavations of the late 6th–5th century B.C. metalworking shops at Pantikapaion[62].

What models of the organization of mining and metal smelting should we assume for the Geometric and Archaic periods? There are few materials which characterize these processes, and besides they do not come from mainland Greece.

Study of the system of mining and ore processing in the Polis region in the western part of Cyprus (fig. 7, 1) has allowed P. Raber to come to the following conclusions[63]. Metallurgical activity in that region concentrated on the previously unexploited mines at Lymni and Kinussi. Sites linked to the mining and smelting of ore are concentrated in the region of Marion[64], although

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58 A.S. Ostroverkhov, 1978; 1979, 118.

59 A.S. Ostroverkhov, 1979, 118-123.

60 *Tskhaltubo*-II, 1981, 181 (A.N. Shcheglov); B.A. Shramko, L.A. Solntsev, L.D. Fomin, 1986, 186 ff.

61 N.N. Terekhova, L.S. Khomutova, 1980, 172 ff.

62 I.D. Marchenko, 1978, 455; M.Yu. Treister, 1987a, 7-8; 1987b, 38-44.

63 P. Raber, 1987.

64 See about Marion and its localization: E. Meyer, 1979, 1029-1030; W.A.P. Childes, 1986.

small agricultural settlements were also located in the proximity of the mines. The grouping of the sites, in which copper was mined and smelted, and of the settlements indicates that ore smelting took place in the vicinity of mines and that the inhabitants of the local settlements were engaged in the process (fig. 7, 2). In the Cypro-Archaic and Cypro-Classical periods, which are characterized by the highest levels of production in the Pre-Roman era, the annual output was about 10-20 tons of copper, showing perhaps the seasonal character of the work. Smelting 250 kg of copper daily it would be possible to make that quantity of metal in one or two months and, thus, metal production may have been incorporated into the agricultural cycle. It is difficult to make any suggestion as to who were the owners of the mines. The mines had been the individual or collective property of inhabitants of the settlements or in the hands of the aristocracy who owned the lands. It is also difficult to determine how copper was distributed in the Archaic period. It was most probably transported via Marion, as was the case in the Classical period. Perhaps, distribution was more or less controlled by a town aristocracy or merchants. Thus, the system of copper mining and smelting belongs to the third model, according to P. Raber's classification[65]. Regrettably, P. Raber has not made a clear chronological differentiation of the system of mining in Western Cyprus. In the course of the late 8th-6th centuries B.C. Cyprus was part of various Eastern empires, first of Assyria, later a vassal dependant of Egypt, then conquered by Persia. The incorporation of Cyprus into the system of Eastern empires implies a higher level of centralization of economic function than was the case in Greek city-states of the same period. This is indirectly proved by the fact mentioned by P. Raber, namely that the model of mining and ore processing, characteristic of the region of Polis, was typical of other regions of Cyprus in the period discussed. However, P. Raber's hypotheses are based on a practically unsupported claim for the role of Marion in the distribution of metal. If one makes an attempt to reconstruct the trade contacts of Marion on the basis of ceramic finds, the following picture is seen. Chian pottery occurred in the last quarter of the 7th—6th centuries B.C., East Greek in the 6th century B.C., especially in the second half[66].

Returning to the problem of the output of metal from mines

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[65] P. Raber, 1987, 305-306, 309-310.
[66] A.-M. Collombier, 1987, 245.

the following observations can be mentioned. For instance, the recent analysis of slag heaps at Baratti, Populonia, dated by radiocarbon between 600 and 100 B.C., allows us to estimate the total iron production at about 1400 tons, or about 3 tons a year for the proposed period of 500 years. However, there is a good case for arguing that the slag at the Baratti deposit mainly represents the production of copper rather than that of iron. Speculating on the potential output of copper, scholars, assuming that one-third of the slag indeed derives from iron-working and two-thirds from copper working, have come to the conclusion that the total production of smithed blooms would have been 470 tons and the total production of copper would have been about 600 tons. These are still significant amounts, representing about 1 ton of each metal per year for the proposed 500-year period of operation. If all of the slag comes from copper-working, which seems more likely, then the total production of copper could have been over 800 tons[67]. The members of the joint archaeological-archaeometallurgical expedition of the Deutsches Archäologisches Institut and the Deutsches Bergbau-Museum at Feinan, Jordan came to the conclusion that the peak of copper production there is to be dated to Iron Age II, the period in which spectacular underground workings—with shafts up to 50 m deep—were developed throughout the Levant. Two smelting sites at Feinan and Khirbet en-Nahas, examples of metallurgical activity on an industrial scale, were probably controlled by the Edomite government. Enormous slag heaps testify to a metal production of between 5000 and 10000 tons[68].

### *2.2.1. Metalworkshops in the Light of Archaeological and Archaeometallurgical Studies*

Our knowledge of Greek metalworking in the period of colonization is highly fragmentary. Production remains of the 6th century B.C. are known at Athens, Corinth, Olympia, and Thasos[69]. 8th-7th c. B.C. workshops were practically unknown till recently, and only excavations of the last decade have produced any results, in particular, at Corinth (fig. 8)[70].

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[67] See: P. Crew, 1991.

[68] B. De Vries, 1992, 511.

[69] C.C. Mattusch,1975; 1977; 1977a; Y. Grandjean, 1988, 243-250; G. Zimmer, 1990, 27-29, 32.

[70] Ch.K. Williams II, J.E. Fisher, 1971, 5-10; J.B. Salmon, 1984, 99.

To the workshops earlier unearthed to the south of the temple of Apollo Daphnephoros at Eretria we can now add the bronze-workshop of the second half of the 7th century B.C. also situated near the temple[71].

However, Ch. Risberg assumes that the building with a pit found to the east of the temple and tentatively interpreted by the excavators as a bronze-smith's workshop with a casting pit awaits further publication to check that hypothesis[72]. In 1980 a painted Geometric skyphos was found to the north of the temple dated to the last decades of the 8th century B.C. and contained a large quantity of gold and electrum ingots of various shapes and weights, and fragments of wire and broken articles with a total weight of 510 gr.[73]. During 1983 excavations at Kommos on Crete near to temple B produced the debris of a metalworkshop containing iron slag and loops[74].

This list should be probably completed by the addition of the workshop near to the temple of Athena Itonia at Philia in Thessaly and of the bronze-workshop at the sanctuary of Artemis and Apollo at Kalapodi. At Philia remains have been found which have been interpreted by K. Kilian as indications of both bronze- and iron-working in the vicinity of the sanctuary. Misshapen castings, casting debris, partly finished artefacts and some raw materials along with stone implements and tools, point, according to Kilian, to the local fabrication of votives, weapons and articles of everyday use, such as dress-pins and knives[75]. At Kalapodi, the evidence of metalworking seems to indicate that bronze and iron artefacts were manufactured at least from the later half of the 8th century. However, Ch. Risberg mentions, on closer inspection the evidence of metalworking in the Late Geometric period amounts to one unsuccessfully cast male figurine[76].

To ca. 800 B.C. is dated the hoard of a jeweller from Tekke near Knossos, where two clay vessels were found to contain numerous ornaments, items of ivory, rock crystal and amber, as well as gold, silver and electrum ingots[77].

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[71] N.A. Winter, 1984, 54 f., fig. 2; S. Huber, 1991.

[72] A. Altherr-Charon, 1981, 81f.; cf. Ch. Risberg, 1992, 37-39. See, however, S. Huber, 1991.

[73] P.G. Themelis, 1983; Ch. Risberg, 1992, 39.

[74] N.A. Winter, 1984, 467; J.W. Shaw, 1984, 283.

[75] K. Kilian, 1983, 145, Abb. 3; Ch. Risberg, 1992, 36-37, fig.4.

[76] R.C. S. Felsch, 1983; Ch. Risberg, 1992, 36, fig. 3.

[77] See, e.g.: J. Boardman, 1967; B. Deppert-Lippitz, 1985, 66.

At Akvovitike in Messenia in 1969 were unearthed fragments of moulds for casting tripods, similar to those found in Olympia, dating to the Geometric period, together with bronze and iron slag. Although the exact localization of the workshop is impossible, it probably belonged to craftsmen casting votives at the sanctuary[78].

At Olympia were found casting moulds, miscasts and semi-manufactured objects, proving the existence of local bronze-working in the 8th century B.C.[79], however to date no remains of actual workshops have been found from the Geometric period. Most of the material mentioned has been found in the northern part of the sanctuary, i.e. in the Altis. This has led W.-D. Heilmeyer to assume that the production site was situated in this area as well, on or below the terrace of the treasuries. There are also indications of metalworking in the area of the stadium from the Late Geometric period[80].

A defective cast of a griffin protome, dating from the 7th century B.C., comes from Samos[81]. Excavations at the Heraion have revealed the remains of bronzeworking (fig. 9): a casting pit and a bronze cauldron with a dedication of Brychon[82].

In Greek colonies of the 8th-6th centuries B.C. the remains have been found of metal workshops and of objects connected with the treatment of metals. The best-known examples are the finds from the excavations of ancient Pithekoussai on the island of Ischia, where the earliest Euboean colony existed from the middle of the 8th century B.C.. There, at Scarico Gosetti, was found the debris of a workshop, dating from the 8th century B.C.: a large amount of iron slag, sherds of crucibles, and the clay nozzles of bellows[83]. Many publications state that analysis of the iron ore found at Scarico Gosetti has proved its Elban origin. This suggestion based on analysis served as an important argument in favour of the close connection between the process of colonization and the search for metals. An especially clear formulation of the idea that the search for metal was the reason behind the Euboean colonization of Pithekoussai has been given by A.M. Snodgrass[84].

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[78] G. Zimmer, 1990, 21.

[79] W.-D. Heilmeyer, 1969; G. Zimmer, 1990, 21-24.

[80] W.-D. Heilmeyer, 1969, 4f., 21; cf. Ch. Risberg, 1992, 33-34.

[81] P.C. Bol, 1985, 78-79, Abb. 50; C.C. Mattusch, 1988, 36-37, fig. 3.7; C. Rolley, 1986a, 24, fig. 2; G. Zimmer, 1990, 30-32.

[82] G. Schmidt, 1972; G. Shipley, 1987, 88-89.

[83] D. Ridgway, 1973, 17 f.; 1992, 90-91, fig. 24; G. Zimmer, 1990, 19.

[84] A. Snodgrass, 1980, 335. See also S. Morris, 1992, 141: "Euboeans sought rich iron ores in Etruria and North Africa west of Utica".

However, the results of analysis should be treated carefully. For example, the geologist B. Kreulen considers that although the iron ores of Chalcis and Elba are both hematites, they can be differentiated only by means of microadmixture analyses, which had not been done. Thus, it is risky to make any definite assertions about the origins of the ore found at Scarico Gosetti[85].

In 1969-70 at Mezzavia on Ischia an area was unearthed consisting of four houses, the inhabitants of which had been engaged in metalworking (iron, bronze, lead) from the middle of the 8th till the early 7th century B.C.. Besides finds of iron bloom, slag, fragments of bronze plaques and wire, bronze and lead ingots, and some unfinished bronze fibula, a weight of 8.79 gr was found, which is very close to that of the Euboean stater[86]. It is suggested that this pre-monetary weight was used either to weigh out the quantities of precious metal required for the manufacture, for instance, of silver ornaments, or, perhaps as part of a set, to weigh finished products with a view to establishing their value[87].

Recently the remains of metalworking, including a casting mould dating from the late 7th-early 6th century B.C., were unearthed during excavations of the Acropolis of Selinus[88].

A metalworking shop was also found during excavations of the fortress of Meṣad Ḥashavyahu located between Jaffa and Ashdod on the Mediterranean coast, where a detachment of Greek mercenaries was stationed in the last third of the 7th century B.C.[89].

Let us turn to the North Pontic material. It is noteworthy that most of the recently discovered remains of metal workshops are dated to the 6th century B.C.. Early workshops and production remains have been unearthed on the island of Berezan, at Olbia and in the settlements of Olbian chora, in the Yagorlyk settlement, at Nikonion, Pantikapaion, and Thorikos[90]. Besides these, a hoard was found at the Berezan settlement which contained gold items and electrum coins of Erythres or Miletus and was probably hidden by a jeweller in the early 6th century B.C.[91]. The number of

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[85] S.C. Bakhuizen, 1976, 66, note 83.

[86] G. Buchner, 1971, 65-67; B. D'Agostino, 1973, 213-214; G. Zimmer, 1990, 16-18; D. Ridgway, 1992, 91-96.

[87] D. Ridgway, 1992, 95.

[88] M.H. Fourmont, 1991, 7, 11, fig. 5.

[89] J. Naveh, 1962, 93.

[90] A.I. Furman'ska, 1958; V.V. Lapin, 1966, 160; A.S. Ostroverkhov, 1978, 1981; V.V. Ruban, 1979; D.B. Shelov, 1979; S.Ya. Ol'govskij, 1982; K.K. Marchenko, Ya.V. Domanskij, 1983, 69, pl. 10,7; M.Yu. Treister, 1984; 1988c, 26; 1992a, 73-82; Ya.V. Domanskij, 1985, 272.

[91] P.O. Karyshkovskij, V.V. Lapin, 1979, 105; cf. J. Hind, 1984, 79-80.

metalworking shops found in the early layers of Greek colonies is not very extensive, but most probably gives a real picture of economic life in the early cities.

To summarise, I would stress that the theses put forward by some scholars which stress the paucity of ore deposits and the low levels of extraction from them in the period of Greek colonization, are unfounded[92]. At the same time, evidence to prove that mines were exploited in regions of Greek colonization, and to show the presence of the remains of metalworking shops in the early layers of the colonies is insubstantial and sometimes completely absent.

### 2.2.2. *Workshops in the Light of the Stylistic Analysis of Metal Objects*

#### 2.2.2.1. *The Geometric Period*

Stylistic analysis of metal articles allows us to single out centres of metalworking activity.

The most important bronze-working centres in the Geometric period were Ionian Athens and Doric Argos with a rather less active role being played by Sparta and Corinth. The output of the big workshops was of inter-regional importance and was distributed over the whole of Greece.

In Greece a large number of small workshops appeared. For example, in the north-east of Greece, workshops probably existed on Thermos and Ithaca; the local manufacture of bronze votive figures also took place in Thessaly, Macedonia and Thrace. The development of these centres of production of artistic bronzes was influenced by the prominent artistic schools of Corinth, Sparta, and Argos[93].

Typological analysis of some categories of mass-produced bronze articles allows us to determine the centres of their manufacture with a high degree of probability. For example, the Geometric period was the time when the main types of Greek helmets, which further developed in course of several centuries, were

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92 C. Roebuck, 1959; J.N. Coldstream, 1979, 19; *The Expansion of the Greek World*, 1982, 426; cf. the point of view expressed by J.C. Waldbaum, that Greece in the Early Iron Age could provide its necessities in metals except for tin; see: J.C. Waldbaum, 1978.

93 W. Fuchs, J. Floren, 1987, 65-68.

elaborated. Among votive objects, the most popular were tripods and animal statuettes. At the same time, the identification of the production centres of several types of 8th-7th c. B.C. bronze articles is extremely difficult.

There were some jewelry centres in Geometric Greece, fashioning ornaments in gold, silver and electrum: Athens, Lefkandi on Euboea, Corinth, and Knossos on Crete[94]. It is quite probable that there was also a Laconian workshop, although there is not enough material at present to identify it[95].

## The Peloponnese

### Argos

As J.N. Coldstream has pointed out, in rich Attic graves of this time, gold ornaments were the chief indicators of prosperity; in the Argolid, wealth is more often expressed in iron. In the rich warrior grave 45 well known for a set of bronze armour, there were found twelve fragmentary spits, or *obeloi*, and a pair of fire-dogs[96].

The second quarter of the 8th century B.C. saw the emergence of a type of votive bronze figure of Argive style, usually depicting horses and bulls, known from finds in Argos and at Olympia[97]. In the Late Geometric period figures of horses were used for the decoration of tripods, which were wide-spread in Greece in that period[98]. There is a variant of such horse figures which developed under the influence of the Laconian type, and is typical, mainly, of the second quarter of the 8th century B.C.[99]. The so-called Classical Argive style had been established by the middle of the 8th century B.C.[100], although the fact did not preclude local imitations of Corinthian and Laconian items in the third quarter of the 8th century B.C.[101]. The flourishing of the Argive school took place in ca. 760-730 B.C.[102]. In the second-third quarters of the

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[94] R. Higgins, 1980, 95.

[95] R. Higgins, 1980, 101.

[96] J.N. Coldstream, 1977, 146-148, fig. 47.

[97] J.N. Coldstream, 1977, 149; W.-D. Heilmeyer, 1979, 54 ff.; C. Rolley, 1992a.

[98] J.N. Coldstream, 1977, 149-150; M. Maass, 1978.

[99] J.-L. Zimmermann, 1989, 31-34.

[100] J.-L. Zimmermann, 1989, 34-35. Cf. J.N. Coldstream, 1977, 149: "It must be acknowledged that the Argive manner cannot yet be defined with the same clarity as the schools of Corinth and Sparta".

[101] J.-L. Zimmermann, 1989, 45-47.

[102] J.-L. Zimmermann, 1989, 56-57.

8th century B.C. Argive plastics included figures of a warrior with spear and centaurs[103]. It is considered by some scholars that in the 9th—first half of the 8th century B.C. Argos was the most prominent centre for the manufacture of tripods in Greece, although C. Rolley is somewhat sceptical about that hypothesis[104]. In the Geometric period Argos was the main centre for the production of bronze pins in Greece[105]. The so-called *Kegelhelmen* were most probably produced in Argive workshops in the last third of the 8th—7th century B.C., perhaps following Assyrian prototypes (fig. 10)[106].

The bell-shaped corslet from an Argive warrior grave is the earliest known body-armour from Iron Age Greece. It is maintained that it has a remote ancestor in an early Mycenean panoply from Dendra; but intervening stages can be seen in a series of corslets from the Urnfield culture of Central Europe; the most likely route for the transmission of the idea from Central Europe back to Greece is through Italy, where early Greek merchants and colonists could have seen imported Urnfield body-armour[107].

It may be supposed that the earliest known Geometric bronze hand-mirrors were manufactured at Argos rather than at other workshops of the Peloponnese[108].

### Laconia

From the beginning of the formation of the Laconian style in Geometric bronze plastics it was characterized by its homogeneity. In contrast to other centres, the production of large tripods was not popular here. Local items were not variegated; 82% of them belong to one type. However, the most typical articles of Laconian manufacture were horse figures. It is only in the figurines that we find any sign of a local style, most clearly seen in the horses[109]. From the late first quarter till the middle of the 8th century B.C. articles in the Laconian style were manufactured only at Olympia. It has been maintained that the prevalence of Laconian bronzes at Olympia lends some colour to the tradition of an early alliance

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[103] J.N. Coldstream, 1977, 150-151; W. Fuchs, J. Floren, 1987, 45-51.
[104] C. Rolley, 1986a, 68; 1992a.
[105] I. Kilian-Dirlmeier, 1984; C. Rolley, 1988, 347.
[106] H. Pflug, 1988, 16-21.
[107] J.N. Coldstream, 1977, 148.
[108] G. Zimmer, 1991, 16-21; cf. U. Höckmann, 1994, 374.
[109] J.N. Coldstream, 1977, 160.

between Sparta and Elis, an alliance which eventually curbed the power of king Pheidon of Argos[110]. About 740 B.C. the production of Laconian statuettes at Olympia slowly died out. The distribution of Laconian figures developed in two main directions: 1) to the north-west towards Tarentum[111]; and 2) in the north-east in the direction of Samos. It is supposed that the fact that sanctuaries received Laconian *ex-votos* was not accidental, but reflected relations at a higher level rather than trade contacts. If we bear in mind the distribution of Laconian-style statuettes after the mid-8th century B.C., it is possible to affirm the existence of both workshops in Sparta and of "*artisans laconiens itinerants*"[112].

The workshops of Sparta cast votive bronze statuettes which were different in style from those manufactured in other centres of the so-called Laconian style, which were distributed not only in Greece proper, but also over the islands of the Aegean Sea, including Samos. A significant number of Laconian bronzes originates from sanctuaries, mainly those of Artemis Orthia, and outside Sparta from Olympia. In the late third quarter of the 8th century B.C. the influence of the Attic school is seen in the production of Laconian workshops, for example in the figures of spearthrowers and centaurs[113]. C. Rolley considers Sparta to be the leading bronze-working centre of Greece, stating that till the 6th century B.C. Sparta was a centre of lively artistic and literary activity[114].

## Messenia

The production of local workshops, where bronze horse figures were manufactured, is dated to the period ca. 780-730 B.C. The bronze workshops of Messenia were strongly influenced by Laconian workshops, so it is impossible to argue for the formation of a true Messenian style[115].

## Corinth

The end of the first or at the beginning of the second quarter of the 8th century B.C. saw—under the influence of the Late Geo-

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[110] J.N. Coldstream, 1977, 163; J.-L. Zimmermann, 1989, 171, note 420.
[111] J.-L.Zimmermann, 1989, 171, note 422.
[112] J.-L. Zimmermann, 1989, 172.
[113] C. Rolley, 1986a, 68; W. Fuchs, J. Floren, 1987, 51-56.
[114] C. Rolley, 1986a, 66; see also: J.-L. Zimmermann, 1989, 173.
[115] J.-L. Zimmermann, 1989, 114-122.

metric Argive style—the elaboration of a local style and of characteristic manufacturing techniques for the casting of horse figures. Finds of such local items are not only broadly represented at Olympia and Delphi, but some pieces are known from Syracuse, Samos, and Aegina; they served also as prototypes for numerous imitations in Thessaly and Macedonia. In the course of the second half of the 8th century B.C. articles in the Corinthian style exerted a certain influence on the work of Attic and Laconian craftsmen[116]. Besides votive figures of horses, bird figures were also cast, though neither warrior statuettes nor tripods were produced in the Corinthian workshops of the Geometric period[117].

Corinth, it has been suggested, led the way in the manufacture of bronze pins distinguished by three biconical bulbs and a long bead-and-reel finial above the disc head[118].

Perhaps the simple gold jewelry found in graves of central Corinth and in two votive dumps at the sanctuary of Perachora was of local Corinthian manufacture[119].

### Arcadia

Different points of view have been expressed concerning the existence of Geometric workshops in Arcadia: they vary from a recognition of the existence of an Arcadian style proper in small bronze plastics, to a determination of articles of Arcadian manufacture as second-rate, hybrid imitations of articles of Argive and Laconian types[120]. Analysis of Geometric horse figures has led J.-L. Zimmermann to the conclusion that a large number of votive figures of various qualities was produced in Arcadian workshops. According to his calculations, the Arcadian workshops produced fewer figures than the Elean, Argive and Laconian ones, whereas 10% of votive horse figures found at Olympia were of Arcadian manufacture. Stylistically articles of Arcadian manufacture do not form a true entity, but are rather interpretations of compositions borrowed from Laconian and Argive craftsmen and combined

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[116] J.N. Coldstream, 1977, 175-176; J.-L. Zimmermann, 1989, 176-202.

[117] C. Rolley, 1986a, 68; 1991, 283; W. Fuchs, J. Floren, 1987, 58-60; cf. J.N. Coldstream (1977, 176): "The human figures were all made as attachments to the handles of tripod cauldrons, and the progress of a Corinthian style can be reconstructed from among the finds at Ithaca and Delphi".

[118] J.N. Coldstream, 1977, 175.

[119] J.N. Coldstream, 1977, 174.

[120] See: J.N. Coldstream, 1977, 156-157; J.-L. Zimmermann, 1989, 91 (with bibliography).

with characteristic technical solutions. Argive influence was fairly constant in the course of the 8th century B.C. from the end of its first quarter, while Laconian influence is distinctly seen at the beginning of the third quarter of the 8th century B.C.[121].

Elis

Olympia

Judging by the finds of miscasts, bronze votive horse figures in the Laconian style were cast at Olympia; numerous finds of similar *ex-votos* are known from there. The workshop was probably established by Spartan craftsmen[122]. About the middle of the 8th century the manufacture began of votives following Argive prototypes[123].

In a recently published work M.Byrne lists about 40 Geometric bronze warrior figurines, most of which belong to the early group and are naked with arms spread and helmets and other indications of armour. In the course of the 8th century B.C. the type becomes established. Two series of figurines were also developed, both employing the warrior stereotype: the so-called *Pferdeführer* and charioteers. It seems that the earliest Olympian figurines testify to a transfer of this motif from Crete[124]. Much rarer are bronze female figurines[125]. A locally cast votive figure of a charioteer has been dated to the last quarter of the 8th century B.C.[126].

Elean bronzeworking shops also existed at Olympia and produced numerous votive figures of horses and bulls, these being simplified versions of the highly artistic items of the Attic, Argive, Corinthian and Laconian styles[127]. In the same workshops and after the middle of the 8th century B.C. the manufacture began of bronze hammered tripods with cast figures, imitating Attic examples, and beginning in the third quarter of the 8th century B.C. the production began of spearthrower figures following Attic and Laconian prototypes. Votive carriages appeared there in the first half of the century, and late examples of this type, dating from the

[121] J.-L. Zimmermann, 1989, 97-113.
[122] W.-D. Heilmeyer, 1979, 15, 110-131; N 458-460, 475; C. Rolley, 1986a, 68.
[123] W. Fuchs, J. Floren, 1987, 52; cf.: J.-L. Zimmermann, 1989, 88-90.
[124] M. Byrne, 1991, 21-47, see catalogue on pp. 226-229; see also R. Thomas, 1992, 49.
[125] M. Byrne, 1991, 229-230.
[126] W.-D. Heilmeyer, 1981, 68-71.
[127] J.-L. Zimmermann, 1989, 76-87.

last quarter of the 8th century B.C. show that along with imitations of Laconian school articles, Elean bronzeworkers created certain new stylistic features which allow us to argue for the formation of a heterogenous Lacono-Elean style[128].

## Central Greece

### Attica

A group of 8th century B.C. bronze votive horse figures, found on the Acropolis of Athens, is of local production[129]. Hammered bronze tripods with cast figures of horses or warriors, holding spears, of Attic manufacture have been found not only in excavations of the Athenian Acropolis, but also at the Pan-Hellenic sanctuaries at Olympia, Delphi, Dodona, and Delos[130]. It has been stated that the earliest of these are dated only to the middle of the century; this is in contrast to the development of the ceramic industry, which had flourished since Proto-Geometric times. The latest handle figures show that Athenian smiths went on making Geometric tripod cauldrons for at least two decades after ca. 700 B.C.[131]. Analyzing bronze figures of horses of the Geometric period, J.-L. Zimmermann singles out a group of figures, imitating articles of Argive manufacture of the middle—second half of the 8th century B.C.[132], and at the same time, defines true Attic style and manufacturing techniques, which took shape in ca. mid-8th century B.C. under the influence of Peloponnesian schools. The production of Attic workshops practically does not extend beyond the second half of the 8th century B.C.. In spite of certain variations in style one can argue for the formation of an original type of Attic horse figure. The heyday of the manufacture of small bronzes took place at the juncture of the third and the last quarters of the 8th century B.C.

From the point of view of the quantity of their production, the Attic workshops, which preserved an important role till the end of the century, are comparable with those of Thessaly, are inferior to those of the Peloponnese, and outproduce the workshops of

[128] W. Fuchs, J. Floren, 1987, 61-63.
[129] J.-L. Zimmermann, 1989, 269 f.
[130] J.N. Coldstream, 1977, 126-129; M. Maass, 1978, 95-104; W. Fuchs, J. Floren, 1987, 37-40.
[131] J.N. Coldstream, 1977, 129; C. Rolley, 1986a, 70; 1991, 282-283.
[132] J.-L. Zimmermann, 1989, 278.

Northern, Western and Central Greece. It is not possible to confirm a mass or serial production of horse figurines. In the third quarter of the 8th century B.C. the produce of Attic craftsmen in practice only reached the sanctuaries of Athens and Olympia. Later on the sphere of their distribution became wider, now including Delphi, Delos, and perhaps also Thessaly[133].

Probably in the last quarter of the 9th century B.C. the workshops of Phoenician jewellers were established in Athens, which were produced articles of high artistic quality, decorated with filigree and granulation. Gold diadems found in Attic burials of the third quarter of the 8th century B.C. were probably produced by Rhodian workshops, or, as J.N. Coldstream maintains, may well be the work of a semi-hellenized guild established somewhere in Attica, catering for aristocratic patrons in Athens and Eleusis. During the 730s B.C. new matrices came into use, which show marked changes of style and theme—in the last quarter of the 8th century B.C. the Athenian jewelry workshops produced more primitive articles, mainly stamped diadems with figures of warriors, riders and centaurs and pins[134]. This was probably connected with the influx of a new group of craftsmen. 7th-century B.C. gold ornaments of Athenian manufacture are unknown[135].

Five gold plaques from Eleusis, forming part of a large breast ornament, combine techniques inherited from oriental jewellers with patterns adopted to local tastes. J.N. Coldstream designates this group as articles of the "Eleusis School", to which, in his opinion, also belong three more plaques from the sanctuary of Artemis at Brauron and two groups of ear-rings. The "Eleusis School" was working between ca. 800 and 750 B.C.[136].

### Euboea

Three categories of metalwork are well represented in Eretrian cemeteries: gold diadems, bronze cauldrons and iron weapons.

Gold items of the second half of the 8th century B.C. found chiefly in the necropoleis of Eretria and the island of Skiros be-

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[133] J.-L. Zimmermann, 1989, 287-292.

[134] D. Ohly, 1953; J.N. Coldstream, 1977, 123-126, 132; T. Hackens, 1980; W. Fuchs, J. Floren, 1987, 43-44; D. Musti et al., 1992, 25-28.

[135] J.N. Coldstream, 1977, 125; R. Higgins, 1980, 96; B. Deppert-Lippitz, 1985, 54-60, 71-79; D. Musti et al., 1992, 28.

[136] J.N. Coldstream, 1977, 125-126; D. Musti et al., 1992, 27.

long to the production of a jewelry workshop at Lefkandi[137]. These gold diadems are provincial work following Attic specimens. At the same time, Geometric bronzes, found on Euboea, are mainly represented by imported pieces of Attic and Peloponnesian origin, while bronze tripods from Lefkandi were cast by wandering Argive bronze smiths, rather than by local craftsmen[138].

Iron weapons, primarily swords and spearheads, are abundant in cremations, in a period when military equipment was not often placed in graves elsewhere[139].

### Locris

The typological poverty of horse figures, on one hand, and the fairly wide and dispersed distribution of finds, on the other, make it difficult to single out local styles and workshops in Eastern Locris, Phocis and Boeotia[140].

The activity of the Locrian workshop is practically limited to the second half of the 8th century B.C.. From the point of view of production size it is comparable to the Phocian workshop, but the distribution of its output was more limited.

Judging by the diffusion of these figures in Locris, the workshop should be probably localised at Opus. However, as J.-L. Zimmermann has stated, the bronzeworkers may have left one sanctuary for another on the occasion of great temple feasts, so that the influence of various other trends (Thessaly, Attica, and the North-Western Peloponnese) led to the formation of a true Locrian style[141].

### Phocis

Except for a small group of horses (group B "Phocis-Locris" after J.-L. Zimmermann)[142], the most of the statuettes attributed to Phocian production on technical grounds form a simplified version of the Corinthian type; stylistically they rather resemble Aetolian and Thessalian bronzes[143].

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[137] J.N. Coldstream, 1977, 198-199; R. Higgins, 1980, 104; D.Musti et al., 1992, 27.
[138] J.N. Coldstream, 1977, 198-199; W. Fuchs, J. Floren, 1987, 64-65.
[139] J.N. Coldstream, 1977, 199.
[140] J.-L. Zimmermann, 1989, 218; cf. C. Rolley, 1991, 283.
[141] J.-L. Zimmermann, 1989, 226-229.
[142] J.-L. Zimmermann, 1989, 236-237.
[143] J.-L. Zimmermann, 1989, 237-238.

The activity of the Phocian workshop is limited to the last third of the 8th century B.C.. The quality of its production is mediocre, and from that point of view they are not comparable with Corinthian bronzes; the quantity of its output is lower than that of the Aetolian and Thessalian workshops, but is comparable to that of the Locrian workshop. The localization of the workshop is a difficult task. The considerable number of Phocian bronzes found in Pherae (Thessaly) allows us to assume that work was undertaken on the spot by Phocian craftsmen, who travelled from sanctuary to sanctuary in search of customers. On the other hand, one may maintain that bronzes found in Kalapodi and Delphi were possibly the work of Phocian bronzeworkers[144].

Delphi

Most of the bronze tripods found at Delphi originated from Argos and Athens, although local imitations are known. Votive bronze horse figures belong to the production of Athens, Sparta and, in particular, of Corinth, while bull statuettes are mainly of local workmanship. Numerous bird figurines were cast in local and North Greek workshops. Several articles of local production, e.g. the statuette of a spearthrower, show contamination from elements of two chronologically different Argive prototypes[145].

Delphi has yielded the largest number of male bronze warrior figurines after Olympia, however, apart from a few finds, the rest of the series runs from the second quarter of the 8th century B.C. The style of the early figures is very similar to that of some of the Olympia series, and it has been argued that both groups come from workshops in the north-east Peloponnese[146], or given the fact that the statuettes from Delphi postdate the figurines from Olympia, that the motif has been borrowed from Olympia[147]. As in the Olympia figurines, Cretan features are also apparent among the Delphi series of warrior figures[148].

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144 R.C.S. Felsch, 1983, 123; K. Kilian, 1983, 145; W. Fuchs, J. Floren, 1987, 63-64; J.-L. Zimmermann, 1989, 239, note 167. See, however, J.N. Coldstream, 1977, 178-179, suggesting that a fair proportion of the bronzes found at Delphi was supplied from Corinth.

145 J.N. Coldstream, 1977, 179; W. Fuchs, J. Floren, 1987, 68-69.

146 H.-V. Herrmann, 1964, 47f.; C. Rolley, 1969, 25f.

147 M. Byrne, 1991, 49-50, 55.

148 M. Byrne, 1991, 54-55.

## Boeotia

The output of Boeotian Geometric bronzeworkers is presented by quadrupeds and big fibulas with incised decoration. Bronze fibulas are the most frequent offerings among metal finds from Boeotian cemeteries. The most typical motives were the bird and the quatrefoil. Later, birds were combined with animals and ships; later still, not much before 700 B.C., man enters the repertoire, and human scenes—often mythical—continue through the first quarter of the 7th century B.C.. Several artists, such as the Swan, the Lion, and the Ship Engravers, were the leading personalities of a central Theban school. There was also a provincial school producing cruder work somewhere in eastern Boeotia[149]. Authentic small plastics of Boeotian workshops, especially horse figures, are unknown. Analysis of bronze votive bull statuettes from the Kabeiros sanctuary at Thebes proves their local manufacture[150].

## North-Western Greece

### Aetolia

It is thought that the bronzeworkers of Aetolia learned their art from Corinthian craftsmen in Kalidon; then in the third quarter of the 8th century B.C. they established their own workshop in Thermon—six of the seven known bronze horse figures of Aetolian workmanship, originating from Aetolia and Akarnania, were found in sanctuaries situated in that region[151]. From a stylistic point of view, the production of the Aetolian craftsmen is a local variant of the Corinthian style, however the quality of manufacture is higher than that of other local imitations[152]. Aetolian figures were produced in the second half of the 8th century B.C. Outside Aetolia most finds of such statuettes are known from Olympia, where they were brought throughout of the whole period of their manufacture, on the other hand, the quantity of Aetolian bronzes clearly grows in north-western and western directions. In all ca. 78% of Aetolian bronzes have been found outside Aetolia[153].

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[149] J.N. Coldstream, 1977, 202-206.

[150] J.-L. Zimmermann, 1989, 240-241; cf. J.N. Coldstream, 1977, 206; B. Schmaltz, 1980.

[151] J.-L. Zimmermann, 1989, 203.

[152] J.-L. Zimmermann, 1989, 214, 216.

[153] J.-L. Zimmermann, 1989, 215-216.

The existence of other workshops in North-Western Greece may be assumed; for example the imitations in Epirus of the Attic tripods have been singled out[154], although there is not enough data to support the thesis of the local manufacture of small bronze figures in Epirus[155].

## Northern Greece

### Thessaly

Practically all the bronze horse figures found in Thessaly originate from sanctuaries in Pherae and Philia. The beginning of the manufacture of bronze figures by Thessalian craftsmen is dated to the late 740s B.C.; the peak of their activity occurred in ca. 725-715 B.C., so that there is a certain delay in comparison with Peloponnesian centres. Outside Thessaly items of Thessalian manufacture are known practically only from the main Greek sanctuaries, i.e. Olympia and Delphi. Thus, the workshops situated at the sanctuaries of Pherae and Philia primarily served local orders[156].

Figures of Corinthian workmanship served as sources of imitation for Thessalian craftsmen, however with the development of their own production the influence of Corinthian bronzes weakened, while at the same time artistic contacts with neighbouring regions, in particular with Macedonia, were developed. From technical and stylistic standpoints contacts with Aetolian craftsmen certainly existed[157].

The production of Thessalian craftsmen was oriented probably exclusively to the sanctuaries. From the quantitative standpoint they outproduced the other regions of Northern, Eastern and Central Greece, but their output was less than that of the Peloponnesian workshops. The quality of manufacture was better than that of the Macedonian bronzes, much more variable than Phocian production, and at the same time inferior to that of the Corinthian and Aetolian workshops[158].

Besides horses and human figurines, Thessalian workshops

[154] C. Rolley, 1977, 102, N 8; 149; M. Maass, 1978, 102, N 13.

[155] J.-L. Zimmermann, 1989, 217.

[156] J.N. Coldstream, 1977, 207, J.-L. Zimmermann, 1989, 258-259.

[157] J.-L. Zimmermann, 1989, 259. J. Bouzek maintains that although Thessalian human figures are reminiscent of Greek bronzes they were perhaps originally connected with the earlier *koine* of Geometric representations of the human body from the Caucasus to Villanovian Italy. See: J. Bouzek, 1988, 54.

[158] J.-L. Zimmermann, 1989, 259.

manufactured bird pendants, some of which imitated Corinthian imports as well as fibulas with a long narrow plate, unengraved, and concave on its outer edge—the bow often with three globes, separated by reels—as well as certain types of pins[159].

## Macedonia

Bronze horse figures originate mainly from the southern regions of Macedonia, the most probable site of workshops, whose activity is dated to the last decades of the 8th—first quarter of the 7th century B.C.[160].

Articles of Thessalian and, to a lesser extent, of Aetolian craftsmen, through whose mediation Macedonian craftsmen became acquainted with the techniques and style of Corinthian bronzes of the second half of the 8th century B.C., influenced the development of a Macedonian product. The relationship of Macedonian bronzework with Thessaly was closer than with any other part of the Greek world. Nevertheless, a large number of Macedonian bronzes were inspired by non-Greek sources (Pontic or Caucasian, and Hallstatt). It is impossible, however, to maintain the existence of an original Macedonian style[161].

The size of output of the Macedonian workshops was somewhat smaller than that of the Thessalian and Aetolian production, but, at the same time, larger than that of the Epirot workshops. The distribution of Macedonian bronzes is limited to finds from local graves and sanctuaries and to finds from Olympia.

Besides bronze horse figures Macedonian workshops produced—though in smaller quantities—bird figures and quadrupeds, as well as pins and button-like ornaments; some of these articles were distributed as far away as Samos (figs. 11-12)[162].

## Crete

Crete was one of the most important centres for bronzeworking in the 10th-9th centuries B.C., developing on the Sub-Minoan traditions, but in the course of the 8th century B.C. the Cretan school

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[159] J.N. Coldstream, 1977, 207, 209; J. Bouzek, 1988, 51-54.

[160] J. Bouzek, 1988, 50-51, fig. 2; J.-L. Zimmermann, 1989, 260-261, 267.

[161] J. Bouzek, 1988, 59; J.-L. Zimmermann, 1989, 266-267.

[162] J. Bouzek, 1988, 51-54; J.-L. Zimmermann, 1989, 266, note 206. See also *Makedonen*, 1994, N 120-121.

gradually lost its creative independence: bronze statuettes of naked youths from the second half of the century obviously imitated the style of the Peloponnesian schools[163]. Bronze tripods of the same date decorated with horse figures are simplified variants of Argive specimens[164]. In contrast to Late Geometric bronze plastics, stamped shield overlays and gold diadems imitated the styles of Eastern prototypes[165]. The production of shield overlays, numerous finds of which were made during excavations of sanctuaries, mainly from those on Mt. Ida, but also at Delphi, started in the mid-8th century B.C. and continued till the beginning of the following century. It proves the existence of close relations between Cretan toreuts and the workshops of North Syria and Phoenicia[166]. It is supposed that craftsmen originating from the capital of Urartu, moved to Crete after it was conquered by Assyria; the workshop was established in the late 9th century B.C. and existed till the early 7th century B.C.; another workshop was perhaps established later in another centre outside Knossos[167].

The earliest examples of bronze sculpture using the sphyrelata technique originate from excavations of an altar of the 8th century B.C. at the sanctuary of Apollo in Dreros[168]. Perhaps this technique, which existed in parallel with hollow casting, was rather more typical of Eastern Greece[169] and these early and experimental images can be attributed to immigrant craftsmen from the Near East[170].

The flowering of jewelry production in Crete was presumably connected with the migration to Knossos of Eastern, probably, Phoenician, goldsmiths in the late 9th century. Their workshop, the so-called Tekke school, existed approximately a century and

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163 C. Verlinden, 1984, 163-171; N 202-239.

164 J.N. Coldstream, 1977, 283; J.-L. Zimmermann, 1989, 297-298.

165 W. Fuchs, J. Floren, 1987, 70-73.

166 J.N. Coldstream, 1977, 287; W. Fuchs, J. Floren, 1987, 142-143; cf.: R.J. Falsone, 1988, 238 ff.

167 C. Rolley, 1986a, 75, 78. Cf. J.N. Coldstream, 1977, 287 (about the shields from the shrine on Mt.Ida): "they are more plausibly attributed to immigrant eastern smiths and their Cretan pupils and their diversity of style implies more than one Cretan centre of production". One of this centres is localized at Knossos, however, there is a large group of shields "made in some Cretan centre other than Knossos, and betokening the arrival- perhaps during the late 8th century- of a new guild of oriental smiths, whose style and iconography were never much modified by local taste".

168 J.N. Coldstream, 281, 283-284, fig. 91; C.C. Mattusch, 1988, 42-44; see about sphyrelata technique also: P.C. Bol, 1985, 97-109.

169 C. Rolley, 1986a, 30.

170 S. Morris, 1992, 163-164.

gradually lost its originally Eastern features, so that the rare finds of jewelry of the 7th century B.C. in Crete are practically identical to analogous finds from Rhodes and the Cyclades[171].

## Rhodes

Rhodes was a significant centre of precious metal treatment; items of the Rhodian school originate not only from the rich necropoleis of Kameiros and Ialysos, but also from Thera, Melos, and Delos. Gold bands with a stamped decoration of the late 8th century B.C. are of local manufacture and show a strong Eastern influence[172].

Spiral earrings, in silver and gold and found in graves of the last third of the 8th century at Ialysos, are simplified versions of the Corinthian type.

Besides these, bronze fibulas, over fifteen hundred of which came to light at the sanctuary of Athena at Lindos, were manufactured on Rhodes. One of these types spread not only on Rhodes, but all over Eastern Greece. However, certain classes of fibulas, for instance those with bows decorated with bird figures are characteristic of Rhodes (the so-called Bird-and-Zigzag Workshop)[173].

## Samos

Although a number of bronze figurines have been found at the Heraion, it is not yet clear whether there was any local production in Geometric times. At all events, as J.N. Coldstream has stated, the most remarkable pieces have strong Peloponnesian affinities[174].

## Magna Graecia

Analysis of some Late Geometric bronze figures from Tarentum and Syracuse prove that they were locally produced from Laconian prototypes[175].

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[171] J. Boardman, 1967; J.N. Coldstream, 1977, 100-102, 281; 1993, 99-100; R. Higgins, 1980, 108; B. Deppert-Lippitz, 1985, 66-69; D. Musti et al., 1992, 28.

[172] J.N. Coldstream, 1977, 250-251; W. Fuchs, J. Floren, 1987, 70; D. Musti et al., 1992, 29.

[173] J.N. Coldstream, 1977, 250, 252.

[174] J.N. Coldstream, 1977, 256.

[175] W. Fuchs, J. Floren, 1987, 73.

### *2.2.2.2. The Archaic Period*

Greek art of the Early Archaic period, the 7th century B.C., which is usually called Daedalic after the Cretan sculptor, is characterized by the borrowing of techniques from Egyptian and Near Eastern craftsmen, which allowed the Greek artists to start the creation of monumental sculptures in stone and bronze. The artistic schools of the Greek islands, particularly Crete and Naxos, were masters of this process, while Samos mastered bronze casting. The development of Archaic plastic art in the 6th century B.C.is associated with four main regions of the Greek world: the Cyclades, the Doric regions of Crete and the Peloponnese, Attica and Eastern Greece[176].

Although the attribution of Archaic bronzes is sometimes very imprecise (e.g. the helmets of the Corinthian type, which in course of the first half of the 7th century B.C. became an integral part of hoplite armament, were most probably manufactured in various workshops, though the model had been probably created in Corinth; fig. 13), the following centres may be mentioned. The first important workshops were those of the Peloponnese: Laconia, Sicyon, Corinth and Argos. Analyzing the stylistic peculiarities of clay imitations of Corinthian metal vessels of the 6th century B.C., E. Pemberton came to the conclusion that the co-existence of extremely similar and varied elements, which had been chronologically synchronous, and the reproduction of motifs over several generations presuppose the importance of adoption of elements and relations between the various centres of artistic bronzeworking[177]. It is rather difficult to identify centres for the manufacture of jewelry—the numbers of Archaic ornaments made of precious metals, especially of gold, are small by comparison to the previous period and finds come mainly from the periphery of the Greek world: from the Northern and Western Pontic area, Southern Italy, and Cyprus.

#### The Peloponnese

#### Argos

As in the Geometric period, Argive bronze workshops of the 7th century B.C. were the leading ones in the Peloponnese: the production of cauldrons with attachments in shape of human figures,

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[176] C. Rolley, 1986a, 83-86; W. Fuchs, J. Floren, 1987, 76-83; R. Thomas, 1992, 57-58; S. Morris, 1992, 238 ff.; F. Croissant, 1992.

[177] E. Pemberton, 1981, 105.

griffin protomes, which were probably known as "Argolid craters" in antiquity, was continued[178]. However, in the 6th century B.C. Argos did not belong to the most important centres for the manufacture of bronze ware, although W. Gauer attributes to an Argive workshop a group of cauldrons with movable handles and attachments in shape of palmettes (with a question mark), suggesting that it was a permanent workshop[179]. Four votive horse figures still cast in the Geometric tradition are dated to the 7th—early 6th century B.C.[180]. Most probably it was again in Argos in the 7th century B.C. that besides the so-called "*Kegelhelmen*", the production of which was started as early as in the Late Geometric period, other types of helmets were being made, including the so-called Corinthian type of the Myros group, dated to the mid-7th century B.C.. Their style of ornamentation is very similar to that of Argive shield overlays[181]. The decoration of the latter was influenced by relief mirrors of the Corinthian style. Argive workshops manufactured shields from the mid-7th to the mid-5th century B.C.; the highpoint of their production lies in the last third of the 7th—first half of the 6th century B.C. They represented the most wide-spread version of these objects in Greece: finds of Argive shield overlays are widely represented in all the Pan-Hellenic sanctuaries[182].

The output of Argive workshops of the 6th century B.C. is represented by insignificant quantities of bronze statuettes of rather crude work, which imitate the styles of works of other Peloponnesian artistic centres[183]. In the late 7th—first half of the 6th century B.C. local founders used lead for casting statuettes in moulds, these including kuroi in the styles of the Cleobis and Biton statues[184]. Similar statuettes are also known in bronze[185]. The existence of another tradition of small bronze plastics is proved by the group of statuettes with emphasised muscles and knees[186].

Only in the late 6th century with the adoption of the hollow-casting technique did Argos return to being of one of the leading

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178 W. Fuchs, J. Floren, 1987, 207-208; P.C. Bol, 1990, 42-43; C. Rolley, 1993, 391-392.

179 W. Gauer, 1991, 60-61, 174.

180 C.F. von Wangenheim, 1988, 65-70.

181 H. Pflug, 1988, 25-26; 1988b, 75, Anm. 55.

182 P.C. Bol, 1989; 1990, 43; cf. C. Rolley, 1991, 284-286 concerning the possibility of local imitations, e.g. in Arcadia, after the Argive models.

183 J. Charbonneaux, 1962, 93-94; B. Barr-Sharrar, 1990, 215.

184 B. Schmaltz, 1980, 15.

185 C. Rolley, 1986a, 94-95, fig. 64; F. Croissant, 1992.

186 C. Rolley, 1986a, 94.

bronzeworking centres of the peninsula[187]. L.O.K. Congdon has singled out a group of caryatid mirrors in the Argive style, only the earliest pieces of which are dated to ca. 490 B.C., and stresses the relativity of attributions[188]. Most probably the group of so-called "Argive prize hydriai", some of which bear inscriptions stating that they were prizes at a feast in honour of the Argive Hera, belongs to the production of the Argive workshop; the earliest of the vessels are dated to the second half of the 6th century B.C., the latest to the mid-5th century B.C.[189].

P.C. Bol, defining the distinctive features of Argive bronzeworking from the Geometric to the Late Archaic period, stresses the extremely rapid transformation of specialization: in this way, the place of cauldrons with tripods which were very popular in the Geometric period was taken by cauldrons with protomes in the Orientalizing period. When the latter had lost their popularity, the Argive workshops started arms manufacture, primarily of shields, and achieved a practical monopoly in that field; furthermore when in the course of the development of democracies large bronze sculptures became wide-spread, Argos was also successful in that field. Naturally, such an ability to react quickly to changes in taste and needs cannot be explained by the fact that at a certain moment an armourer stopped engraving shield overlays and began casting statues. It can be explained primarily by the ability of the city-state to follow all these changes and the existence of skilled craftsmen and materials[190].

### Laconia

Among the Doric centres of the Peloponnese in the 7th-6th centuries B.C., it was Laconia that led in the field of artistic bronzeworking. This is proved both by its typological variety and its artistic level; first-rate products are probably attributable to Spartan workshops, whereas other items were manufactured in provincial workshops. Sparta developed contacts with other artistic centres: in the 7th century B.C. primarily with Crete, later on with Samos and the Cyclades, and in its turn had a decisive influence on the formation of a metalworking school in its colony Tarentum[191].

[187] W. Fuchs, J. Floren, 1987, 207.
[188] L.O.K. Congdon, 1981, 74.
[189] E. Diehl, 1964, 23-25; M.L. Lazzarini, F. Zevi, 1989.
[190] P.C. Bol, 1990, 44.
[191] C. Rolley, 1986a, 107-113; W. Fuchs, J. Floren, 1987, 214-215, 221.

Articles of the Laconian school were extremely widely distributed outside Sparta[192]. Numerous narrative sources concerning the manufacture of artistic bronzes in Sparta are preserved.

The general work by M. Herfort-Koch lists 184 7th-5th century B.C. bronzes: statuettes, mirror handles, and vessels, attributed as Laconian bronzes[193], though not all of the attributions are undisputed[194]. According to M. Herfort-Koch, the specific feature of Laconian bronzes is their applied character, proving the dominant role of these workshops in the manufacture of metal-ware, which was of inter-regional importance[195].

The manufacture of bronze ware in the workshops of Laconia is limited to the narrow period of ca. 590-530 B.C., while the distribution of their products, represented primarily by hydrias, proves that they were items of an export trade: practically unknown in Laconia, they were widespread in the vast territories of the Greek and Barbarian worlds. C.M. Stibbe has recently published a catalogue of Archaic bronze hydriai, including slightly more than 100 items, a considerable part of which is held to be of Laconian production. There has been much discussion about places of manufacture and the dating of certain types. However, specialists in the field agree about several groups, for instance, according to commonly held opinion, bronze hydriai with a female protome, known as the Telesstas series (after the hydria found in Lebadeia (Boeotia) with an inscription written in the Laconian alphabet on the rim, bearing the name of Telesstas; group C according to C. Stibbe) are thought to have first appeared in Laconia at the very beginning of the 6th century B.C. and were soon imitated elsewhere[196]. According to C. Rolley, production was interrupted suddenly, not as the result of internal factors, but because of a cessation of trade, probably due to the fact that they were transported by non-Laconian ships, which stopped calling at the harbours of Laconia perhaps in the course of a war between Sparta and Samos. If we bear mind that these two powers had for a long time been allies, the production of Laconian craftsmen may have earlier been transported on Samian ships[197]. To a certain extent this hypothesis is proved by a survey of relations between Samian and Spartan Archaic bronzeworking. For example, some of the statuettes found in the Heraion of Samos show a certain

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[192] M. Herfort-Koch, 1986, 141-146; W. Fuchs, J. Floren, 1987, 222.
[193] M. Herfort-Koch, 1986.
[194] See: J.B. Carter, 1989, 474-475; H. Philipp, 1989.
[195] M. Herfort-Koch M., 1986; see also: T. Weber, 1983,88-89.
[196] C.M. Stibbe, 1992, 11 ff.
[197] C. Rolley, 1986a, 107, 142.

Laconian influence. On the other hand, C. Mattusch has come to the conclusion that in the third quarter of the 6th century B.C. Laconian bronzeworkers adopted the technique of hollow casting from bronze sculptures from Samos, and she considers the bronze figures from Amikleon in the museums of Sparta and Olympia and the kuroi head from the Boston museum to be the products of Laconian sculptors. Quite probably, we can add to the list of their produce the late 6th—early 5th century B.C. bronze youth's head from Kythera[198].

Up to the late 6th century B.C. bronze cauldrons richly decorated with cast figures and reliefs were produced in Laconia. M. Herfort-Koch considers the bronze krater from the Celtic burial at Vix to be of Laconian origin[199]. The view that bronze kraters with volute handles and applications were of Laconian production is also defended by S. Karuzu[200]. There are also some hypotheses that the Vix krater was manufactured in one of the workshops of Corinth or Magna Graecia (Tarentum, Sibaris, or Rhegium)[201]. In either event the type of krater with volute-shaped handles was called a Laconian krater in antiquity: the manufacture of such bronze vessels in the workshops of Laconia started in the mid-6th century B.C., however they were soon reproduced in Corinth and in the late 6th century B.C. in Tarentum and Samos as well[202]. W.Gauer has maintained that a Laconian workshop, in which cauldrons were produced, tentatively associated with the "*Werkstatt des Lakonier-Kessels*", and representing the highpoint of Laconian artistic bronzeworking, was established by the mid-6th century B.C. in Lydia, fulfilling the orders of Lydian king Croesus and that after the fall of the Lydian kingdom in 546 B.C. Laconian workshops were established in South Italy. The idea of itinerant Laconian craftsmen is in general supported by C.M. Stibbe[203]. A similar picture is seen on analysis of bronze hydriai. Most of the 25 vessels, dated to the first

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198 C.C. Mattusch, 1988, 60-63.

199 M. Herfort-Koch, 1986, 70-73.

200 S. Karuzu, 1979, 78.

201 See: C. Rolley, 1982; 1987, 335-348; *Trésors des princes celtes*, 1987, 218-222, N 136; in his recent article B. Shefton is dating the krater from Vix not later than 530 B.C., arguing against its manufacture in Magna Graecia: B. Shefton, 1989, 219, Anm. 54; see also: E. Maul-Mandelartz, 1990, 142 ff.; W. Gauer, 1991, 172-173. C.M. Stibbe (1992, 5) maintains that scholars tend to date the krater too late and that the main preconception about its being made somewhere in Magna Graecia instead of in Greece itself.

202 K. Hitzl, 1982, 43-83.

203 W. Gauer, 1991, 171-173; C.M. Stibbe, 1992, 5, note 19.

half of the 6th century B.C. and listed by E. Diehl, belong to the production of Laconian craftsmen; in the second half of the century bronze hydriai were also manufactured in the workshops of Corinth and Magna Graecia[204].

The practice of casting of bronze statuettes for dedication at local sanctuaries was, on the contrary, not dying out, although, as C. Rolley has shown, it was deceasing[205]. About one third of all recently found Archaic bronze horse figures, the production of which began in the third quarter of the 7th century B.C. and reached its peak level in ca. 530-520-s B.C., are the products of Laconian workshops[206]. By the middle of the 6th century B.C. the hoplite bronze statuette had been created in Laconia. The new type became fairly quickly widespread[207]. Laconian bronze figures were distributed far beyond Greece. Notable from that point of view is the find of a hoplite statuette of the second half of the 6th century B.C. in Aden[208].

The craftsmen of Laconia adopted from the Egyptians the shape of a mirror with a support in the form of a naked female figure, and were perhaps the first in Greece to begin the manufacture of such mirrors. One cannot however exclude the possibility that the earliest mirrors of this type in Greece were manufactured in Ionia; caryatid mirrors of ca. 620-480 B.C. were found not only in Laconia, but sometimes far further afield: in Cyprus, Sicily, and Etruria. Their distribution was probably connected with festivals of Artemis[209].

### Corinth

Corinthian bronze plastics of the 7th century B.C. are not characterized by any originality of artistic choice: Corinth was inferior to such centres as Sparta or Tarentum in the casting of statuettes. It is noteworthy that none of 60 bronze horse figures is attributed to the Corinthian school[210]. From a group of Corinthian bronze statu-

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[204] E. Diehl, 1964, 7-22.
[205] C. Rolley C., 1986a, 107.
[206] C.F. von Wangenheim, 1988, 30-65, 126-127.
[207] C. Rolley, 1986a, 112; R. Thomas, 1992, 71-72.
[208] K. Parlaska, 1989, 282, Anm. 3, Abb. 3.
[209] L.O.K. Congdon, 1981, 46-50; C. Rolley, 1986a, 108, 112; cf. R. Thomas, 1992, 74-77: "Möglicherweise sind die Anregungen für die Einführung der Stützfiguren insgesamt von Kleinasien ausgegangen".
[210] C.F. von Wangenheim, 1988, 105-106.

ettes of the 7th-6th century B.C.[211], a certain doubt has resulted in the attribution of the finds from Dodona and its vicinity, which may have been produced by local workshops of the Epirot school, whereas a Zeus figure from Munich may be of Tarentine manufacture[212]. C. Rolley considers that Corinthian workshops, which later became specialized in the production of bronze ware and mirrors, began manufacture in as early as the 6th century B.C., while the quantity of bronze vessels made in Corinthian workshops had grown considerably from the mid-6th century B.C. This fact is explained by the expulsion of Corinthian pottery by Attic in the Mediterranean markets[213]. The heyday of Corinthian bronze plastics is dated to the Late Archaic period: as far back as in the second quarter of the 6th century B.C. a series of bronze statuettes of youths was cast; female figures had primarily an applied purpose[214]. L.O.K. Congdon, discussing regional schools on the basis of a special study of caryatid mirrors, singles out the Corinthian school. The mirrors attributed to that school are limited to 540-520 B.C., while the finds of such items originate mainly from Corinth[215].

A study of bronze prochoi of the late 7th—early 5th century B.C. allows I.-K. Vokotopoulou to distinguish several groups of vessels belonging to the production of the Corinthian school, among them those of at least seven Archaic workshops situated in Corinth and a workshop imitating the Corinthian style in a Corinthian colony somewhere in North-Eastern Greece. More than half of these finds come from Epirus (Dodona); I would also like to stress the finds from Trebenishte (7) and Perachora (4)[216]. However, some of the vessels included in the catalogue may be of Attic origin[217]. The group of oinochoai of form 1 and olpes of type B—according T. Weber's typology—which are dated to the last quarter of the 6th—first quarter of the 5th century B.C., may have belonged to the production of Corinthian workshops[218].

Between the late 7th and the early 5th century B.C. Corinth was dominant in the manufacture of shield overlays decorated with fig-

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[211] I.-K. Vokotopoulou, 1975, 170-171, 187-189; G. Kopcke, 1976.

[212] E. Walter-Karydi, 1981, 11-48; C. Rolley, 1986,377-378; C.C. Mattusch, 1988, 68-69; cf. B. Barr-Sharrar, 1990, 212; R. Thomas, 1992, 69-70, Abb. 53.

[213] C. Rolley, 1986a, 102, 144.

[214] W. Fuchs, J. Floren, 1987, 199-203.

[215] L.O.K. Congdon, 1981, 64-68.

[216] I.-K. Vokotopoulou, 1975, 169-170. See about Archaic Corinthian metal vases also H. Payne, 1931, 210-221.

[217] W. Gauer, 1981; 1991, 173-174; cf. C. Rolley, 1987, 349; 1993, 394.

[218] T. Weber, 1983, 88-89; 173-174.

ured reliefs[219] and probably in that of greaves production[220]. Corinthian workshops were most probably the source of so-called Illyrian helmets of type 2 dated to the last quarter of the 7th—first half of the 5th century B.C.—this hypothesis is based primarily on the area of distribution of these helmets in regions adjoining the eastern coast of the Adriatic and in direct proximity to Corinthian colonies: Ambrakia, Corcyra on the island of Corfu, Epidamnus and Apollonia (fig. 14, 1)[221].

Vessels in precious metals were also produced in Archaic Corinthian workshops; this is proven by the find at Olympia of a gold phialai with a dedication by the Cypselids; in the same workshop were probably executed the gold reliefs, which decorated the chest of the Corinthian tyrants—a similar example made of silver in the so-called "Argo-Corinthian" style originates from Delphi. Some silver and gold vessels found in the rich Etruscan tombs of the 7th-6th centuries B.C. may also have been manufactured in Corinth[222]. From compositional and stylistic standpoints the prototypes of bronze shield overlays were gold ornaments with metope friezes of the 7th century B.C.[223].

### Sicyon

Some of the preserved large Archaic bronze statues, in particular the Apollo of Piombino, are ascribed to the workshop of Sicyon[224]. It is considered to be the work of Kanachos for Didymeion (cf. another point of view). The bronze head of Zeus from Olympia may also belong to the Sicyonian school (cf. another point of view)[225]. A group of bronze statuettes of Sicyonian workmanship has been identified[226]. Ancient writers (Plin. N.H.

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219 H. Payne, 1931, 222 ff.; W. Fuchs, J. Floren, 1987, 204, 235-236; P. Bol, 1989.

220 E. Kunze, 1991, 70.

221 H. Pflug, 1988a, 49-50, Abb.9.

222 D.E. Strong, 1966, 57-59, 62, 64.

223 W. Fuchs, J. Floren, 1987, 204. Analysis of a bronze matrix from Corfu in the Ashmolean Museum with metope compositions in the Protocorinthian-Transitional style also proves this suggestion. See about the matrix, e.g. H. Stuart Jones, 1896; H. Payne, 1931, 222, pl. 45, 3; D. Ohly, 1953, 120, R.A. Higgins, 1980, 101-102, pl. 1c; C. Reinholdt, 1987, 196. See with complete references: M.Yu. Treister, in print-5. It seems that the matrix, traditionally dated to the mid-7th century B.C. should be dated from ca. 630-620 B.C. It proves the existence of the Corinthian influenced local toreutic workshop on Corfu.

224 J. Charbonneaux, 1962, 94-95; D. Kreikenbom, 1990, 38, 41, Anm. 83-84.

225 P.C. Bol, 1978, 102.

226 C. Rolley, 1986a, 103, fig. 72; W. Fuchs, J. Floren, 1987, 212-214.

XXXIV.75; Paus. I.16.3; VIII. 46.3) inform us that some of these bronze statues were the joint products of Sicyonian and Argive sculptors.

Arcadia

A group of bronze statuettes in the Arcadian style has been identified. It is represented by figures of shepherds and deities, among which images of Hermes Kriophoros, found in Arcadian sanctuaries in Tegea and on Mt. Lykeion, should be mentioned. Although some statuettes are known from the first half of the 7th century B.C., most of them are dated to the late 6th—early 5th century B.C. and originate from sanctuaries at Tegea, Asee, Lusoi, Phigalia, and Lykosura, where they were most probably cast at temple workshops[227].

Elis

Inscriptions containing dedications by the Eleans to Olympic Zeus are found on the handle of a bronze oinochoai of the late 6th century B.C., which represent a type distributed throughout Greece and Etruria, and on the rim of a lebes, dating from the same time, both found in Olympia, in the opinion of P.G. Calligas. This supports the view that these objects were most probably made in a local workshop, since the public dedications of the Eleans could hardly have been engraved on imported objects[228].

Olympia

Bronzeworking shops established in the Geometric period at Olympia by craftsmen from various centres were still functioning in the 7th-6th centuries B.C. The main type of votive offering was bronze armour, including shield overlays of Corinthian manufacture and imitations of these produced by Argive craftsmen[229]. The earliest variants of the so-called Illyrian helmet are dated to the late 8th-7th century B.C. Early Illyrian helmets were most probably manufactured at a workshop situated in the North-Western Peloponnese, perhaps at Olympia, where most of the finds have been

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[227] J. Charbonneaux, 1962, 91-93; C. Rolley, 1986a, 118-119; W. Fuchs, J. Floren, 1987, 229-230; F. Felten, 1988; B. Barr-Sharrar, 1990, 213-214; R. Thomas, 1992, 64.

[228] P.G. Calligas, 1982.

[229] W. Fuchs, J. Floren, 1987, 236.

unearthed (fig. 14, 2)[230]. In the course of the first half of the 7th century B.C. traditional Geometric cauldrons were replaced by cauldrons with attachments in the shape of griffin protomes, the production of which reached its peak in the middle of the century: Argive craftsmen were the first Greek founders to manufacture them; furthermore they were produced by bronzeworkers from Athens, Corinth, and Sparta, although Samos led their production from the mid-7th century B.C.; in the late 6th—early 5th century B.C. the manufacture of griffin cauldrons flourished in Attica and Ionia[231].

Starting in the Late Archaic period Olympia became one of the largest centres for the casting of bronze sculptures: besides images of deities, statues were cast of champions in the Olympic games. A head of Zeus, dating to the late 6th century B.C., is the work of a local founder, or of craftsmen who had arrived from some other centre[232].

## Central Greece

### Attica

In the first half of the 7th century B.C. Athens continued to be one of the biggest centres for the manufacture of Sub-Geometric bronzes (e.g. massive cauldrons with sculptured attachments). Cauldrons with attachments in the shape of griffin protomes, which were first made by Attic craftsmen in the second quarter of the century, imitated Argive and Samian specimens; beginning in the mid-7th century B.C. Attic toreuts started the production of bronze details for shields and cuirasses. Bronze plastics from the second half of the century are scarce and of local importance[233].

This stagnation was overcome in the first half of the 6th century B.C. and with the adoption of the hollow-casting technique the casting of bronze statues received a new impetus. A group of small bronzes of the Athenian school, represented by a variety of types, can be identified with high probability. Most of the Archaic bronzes found in the Acropolis of Athens are dated to after 530 B.C.[234]. At

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230 H. Pflug, 1988a, 47-48, Abb. 6.

231 H.-V. Herrmann, 1979; W. Gauer, 1984, 51; W. Fuchs, J. Floren, 1987, 234-235.

232 C.C. Mattusch, 1988, 63-65.

233 W. Fuchs, J. Floren, 1987, 237, 301-304.

234 J. Charbonneaux, 1962, 100-103; C.F. von Wangenheim, 1988, 1-15; W. Fuchs, J. Floren, 1987, 304-306.

that period Athenian craftsmen began a series of bronze statuettes, reproductions of the famous Athena Promachos statue. Among approximately a dozen statuettes of that type three or four individual styles are distinguished; it is also possible to assume that they were manufactured at several workshops. Another series of statuettes cast at that time in Athens represented young naked athletes, sometimes making libations, sometimes runners or discus throwers (later figures dated to after 480 B.C.). Bearing in mind the fact that the treatment of features on all the statuettes of this group never changes, C. Rolley considers that the figures were cast in one workshop starting in 530 B.C.[235].

The attribution of mirror supports of the "Athenian" school of ca. 510-480 B.C. is fairly conventional, because they combine stylistic elements which are also typical of the Corinthian, Sicyonian and some other schools[236]. Perhaps in the second half of the 6th century B.C. some Late Archaic helmets of the Corinthian type were manufactured there[237].

In Attic workshops of the 6th century B.C. bronze tripods were cast as well as bronze bowls with sculptured handles in shape of naked youths or lions. These Late Archaic bronzes were imitated in Southern Italy[238].

In contrast to the Classical period the treatment of precious metals was not developed in the Athenian workshops; all that is known is one silver sphinx head, dated to ca. 560 B.C.[239].

## Aegina

The sculptors and founders of Aegina are not once mentioned by Pausanius; Pliny stressed the wonderful properties of Aeginetan alloys (N.H. XXXIV. 10)[240], though a fairly small number of Archaic bronzes are attributed to the production of Aegina. They are dated primarily to the last quarter of the 6th—first quarter of the 5th century B.C., and include a statue head found on the Athenian

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235 C. Rolley, 1986a, 114.
236 L.O.K. Congdon, 1981, 63-64.
237 H. Pflug, 1988, 95.
238 W. Gauer, 1984, 50-51; W. Fuchs, J. Floren, 1987, 306-307.
239 W. Fuchs, J. Floren, 1987, 307.
240 E. Walter-Karydi, 1987, 12-47. Whatever Pliny may have meant by "Aeginetan" bronze, it seems probable that the term originally designated no more than alloy with the particular copper-tin ratio favoured in the workshops of the island. See, e.g., D. Haynes, 1992, 84.

Acropolis[241], several statuettes and mirror stands[242]. E. Walter-Karydi dates only three bronzes to the first half of the 6th century B.C. : mirrors or mirror supports, one of which[243] was dated by J. Charbonneaux and L.O.K. Congdon to the second half of the century and attributed by L.O.K. Congdon to the Island school. Only a helmeted bronze head of Athena is considered to be the work of the craftsmen of Aegina and is dated to the second half of the 6th century B.C. (it was earlier suggested that it was cast between the first half and the middle of the 5th century B.C.)[244]; three more pieces are dated to the first half of the 5th century B.C.[245] (their attribution is also uncertain), including a statuette of Zeus, which may be also considered as work of the Attic school)[246].

Euboea

Several statuettes from the sanctuary of the Dioskuroi in Chalcis are attributed to local workshops[247]. The sculptor Philesius from Eretria cast a bronze statue of a bull at Olympia[248].

Delphi

Numerous finds of bronze statuettes, votive animal figures, executed in the Sub-Geometric style, belong to the output of local workshops. Traditions of the Daedalic style reflected in series of kuroi figures cast in the same mould and cauldron attachments in the Orientalizing style[249].

Boeotia

The workshop at the Kabeirion in Thebes continued its activity into the Archaic period. Bronze and lead votive bull figures were cast there[250]. Bronze statuettes from the Apollo sanctuary at Ptoion are examples of mass production, imitating monumental

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241 B.S. Ridgway, 1977, 76, 83, fig. 12.
242 J. Charbonneaux, 1962, 98-100; L.O.K. Congdon, 1981, 50-52; C. Rolley, 1986a, 103; 1989, 350-351, figs. 3-4.
243 E. Walter-Karydi, 1987, 52, N 17.
244 E. Walter-Karydi, 1987, 73-74, N 32; W. Fuchs, J. Floren, 1987, 311.
245 E. Walter-Karydi, 1987, 84-85, N 61-62a.
246 C. Rolley, 1989, 349-350.
247 B. Schmaltz, 1980, 140.
248 P.C. Bol, 1978, 112, N 134.
249 C. Rolley, 1969.
250 B. Schmaltz, 1980.

sculpture; numerous finds were unearthed there. Some locally cast figures were fashioned following Attic and Sicyonian prototypes[251]. Large bronze sculptures were also cast in Boeotia; this is proved both by finds of statue bases with the signatures of Theban sculptors and by a statue of Apollo found at Piraeus, attributed to the Boeotian school[252].

## North-Western Greece

### Epirus

The local manufacture of bronze statuettes in the workshop situated at the Zeus sanctuary at Dodona was influenced by articles from other artistic centres, in particular, Corinth[253].

The distribution of one of the variants of Illyrian helmets from the second half of the 6th century B.C. along the Dalmatian and Epirot coasts proves that they were produced in one of the local workshops (fig. 15, 1)[254].

### Illyria

The earliest variants of type 3 of the Illyrian helmet, dating primarily to the second half of the 6th century B.C., belong to the production of the workshops situated somewhere on the Illyrian coast of the Adriatic[255].

## Northern Greece

### Thessaly

The production of local workshops included figures of spearthrowers and votive animal statuettes executed in the traditions of Geometric art. Some figures, primarily images of deities, are rather idiosyncratic; applied bronzes, however, imitated specimens cast in major artistic centres[256].

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[251] W. Fuchs, J. Floren, 1987, 317.
[252] W. Fuchs, J. Floren, 1987, 316-317.
[253] E. Walter-Karydi, 1981, 20.
[254] H. Pflug, 1988a, 56-57, Abb. 14.
[255] H. Pflug, 1988a, 57-58.
[256] W. Fuchs, J. Floren, 1987, 322.

## Macedonia

One of the variants of the Late Archaic Illyrian helmet (3 A3), dating to the second half of the 6th—first half of the 5th century B.C., the main finds of which were concentrated in Macedonia, was probably cast in one of the local workshops and combined features of Late Archaic Illyrian and Corinthian helmets (fig. 15, 2)[257].

The finds of 6th century B.C. jewelry in the necropolis of Sindos allow us to pose the question whether Macedonian jewelry workshops existed and and even whether their produce was imported into Attica[258].

## Crete

Rare finds of 7th century B.C. bronze statuettes manufactured in Cretan workshops (C. Verlinden singles out 15 figures of the Daedalic style), prove numerous adoptions of elements from Sub-Minoan and Sub-Geometric art[259]. Bronze votive animal figures are cast in Geometric traditions; 259 figures listed by A.Pilali-Papasteriou had been produced in various workshops[260], at the same time, bronze reliefs from the first half of the 7th century B.C. prove the dominant role of Eastern toreutics[261]. In the early 7th century B.C. Cretan craftsmen continued the manufacture of shields in the traditions of Syro-Phoenician art. Analyses of bronze armour from Fortetsa and Kavussi presuppose the existence at that period of an armoury in Knossos. In the last third of the 7th—first decades of the 6th century B.C. Cretan toreuts produced relief bronze cuirasses found not only at Cretan sanctuaries, but at Olympia and Delphi as well. A workshop, in which votive reliefs with hunting scenes were manufactured, existed in the last third of the 7th century B.C. at the sanctuary of Apollo Dendrite in Kato Symi, where a stylistically homogenous group of finds was unearthed[262]. However, the heyday of the workshop is probably limited to the period of 670-630 B.C. Besides articles of the local

257 H. Pflug, 1988a, 61-63, Abb. 19.

258 S. Miller, 1991; see about the finds from Sindos necropolis also: B. Barr-Sharrar, 1986, 74; *Makedonen*, 1994, N 154-172; 176. See also gold from Late Archaic tombs at Vergina: *Makedonen*, 1994, N 130-140.

259 C. Verlinden, 1984, 172-174, N 240-254.

260 A. Pilali-Papasteriou, 1985, 100.

261 W. Fuchs, J. Floren, 1987, 135.

262 W. Fuchs, J. Floren, 1987, 144 ff.

workshop, A. Lebesi distinguishes reliefs hammered in two other workshops, while the style of the Kato Symi reliefs gives him reason to distinguish the hands of at least seven craftsmen[263]. In 7th century B.C. jewelry shops the manufacture continued of gold items, mainly of hammered gold reliefs. The existence of various metal workshops in Crete in the 7th century B.C. may possibly be explained by the extreme political subdivision of the island[264].

In the 6th century B.C. Crete lost its importance as a leading centre for metalworking and its workshops acquired a provincial character. Rare examples of sphyrelata were manufactured there as early as from the beginning of the 7th century B.C., but fragments of bronze sculptures from the last quarter of the century prove to be imitations of Naxian kuroi, while those of the early 6th century B.C. show the adoption of the hollow-casting technique from Samos. Bronze statuettes of naked youths of the 6th century B.C. are provincial imitations of Cycladic kuroi. Less popular were female statuettes. Cretan cauldrons with cast figured elements of the 6th century B.C. reproduced items of Laconian origin[265].

### The Cyclades

This artistic centre, which made a valuable contribution to the development of Greek monumental sculpture, was barely significant as a centre of metalworking, although some bronze kuroi statuettes are considered to have been produced on Naxos in ca. 630 B.C. (a kuroi from Delphi)[266] and Melos[267]; votive horse figurines are work from Tenos[268].

The island of Melos was in the 7th century B.C. perhaps an independent centre of goldsmithing. The craftsmen of Melos specialized in the manufacture of rosettes for diadems and probably earrings[269].

It is noteworthy that metalworking was not developed on Siphnos, an important place for the gold and silver extraction in the Archaic period[270].

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263 C. Rolley, 1986a, 89; 1988, 354-355.
264 C. Rolley, 1988, 355.
265 W. Fuchs, J. Floren, 1987, 135-146.
266 W. Fuchs, J. Floren, 1987, 159-160.
267 W. Fuchs, J. Floren, 1987, 179.
268 W. Fuchs, J. Floren, 1987, 183.
269 R. Higgins, 1980, 111.
270 W. Fuchs, J. Floren, 1987, 172.

## Eastern Greece

In contrast to the situation with monumental sculptures, first-rate items of carved ivory, and terracottas, the casting of bronze plastics was not developed in Archaic Eastern Greece except at Samos[271].

## Rhodes

The development of the Rhodian jewelry school in the second half of the 7th century B.C. was influenced by the Cretan school and by jewelry centres in Syria and Asia Minor. The main types of ornaments are burial bands, diadems with rosettes, pendants, and bracelets with ends in the shape of animal heads[272].

Rhodes is suggested by some scholars, for instance F. Villard, to be the centre of manufacture of bronze oinochoai dated from ca. 650 B.C.[273] This view was later argued by B. Boloumié and B. Shefton; on the basis of the distribution of finds they suggest an Etruscan manufacture of these bronze vases, while O.-H. Frey maintained that they were initially produced on Rhodes. This point of view seems to be supported by C. Rolley, who considered the Rhodian manufacture of the vase from Kappel[274].

## Samos

The existence of a significant centre of artistic bronzeworking on Samos is proven by numerous finds at the Samian Heraion, most of which are dated prior to 520 B.C., as well as by the names of Telekles, Theodoros and Rhoikos, preserved by ancient writers. To the latter is ascribed the glory of adopting the technique of hollow-casting from the Egyptians and of using it for the casting of large statuary in the first half of the 6th century B.C.[275], though it has been recently stated that this cooperation between Rhoikos and Theodoros is nothing more than a modern hypothesis[276]. However, as some scholars maintain, even if Rhoikos and Theodoros

[271] C. Rolley, 1986a, 119-126; W. Fuchs, J. Floren, 1987, 326.
[272] R. Laffineur, 1978; 1980; B. Deppert-Lippitz, 1985, 69-70, 98-112; D. Musti et al., 1992, 29-30.
[273] F. Villard, 1953.
[274] B. Bouloumié, 1973; 1978; B. Shefton, 1979; O.-H. Frey, 1963; C. Rolley, 1987, 336-341; 1988b, 94-97.
[275] A. Burford, 1972, 110-111, 191-192; C.C. Mattusch, 1988. 47 ff.; W. Fuchs, J. Floren, 1987, 358-359.
[276] V.C. Goodlett, 1989.

cannot be said to have been the inventors of cast bronze statuary, the existence of the Greek tradition crediting them with its invention strongly suggests that they made some crucial contribution to its development in Greece; and it is tempting to suggest that it was they who first realized that full-scale statuary could be cast in sections by means of piece-moulding[277].

Thanks to their activity in a workshop situated at the sanctuary of Zeus at Olympia, Samian bronze founders established close contacts with the leading metalworking centres of the Peloponnese. Having adopted from Argive craftsmen the shape of the cauldron with attachments in the form of griffin protomes, Samian bronzeworkers attained the highest standards in execution in as early as the second quarter of the 6th century B.C. Cast protomes of Samian manufacture which are sometimes of a large size differ from the hammered specimens from the mainland Greece; in the second half of the century siren figures were used as attachments. Samian bronze statuettes of the first half of the 7th century B.C. imitated terracottas and were cast in the Sub-Geometric style. Instead of sphyrelata Samian founders used hollow casting as early as in the last quarter of the 7th century B.C. ; this is proved by the find of a caryatid head of ca. 620 B.C. at Olympia. In the 6th century B.C. Samian craftsmen, sometimes using hollow casting, made bronze kuroi statuettes and figures of donors, which imitated examples from the local school of monumental sculpture[278]. From the middle of the century Samian craftsmen began the production of Laconian-type cauldrons richly decorated at the rims with the figures of humans and animals. In course of the second half of the 7th—mid-6th centuries B.C. Samian toreuts hammered numerous bronze reliefs with mythological scenes which were used as furniture and door overlays both in the Samian Heraion and at Olympia[279].

## Asia Minor

A group of caryatid mirrors, dating from after the middle of the 6th century B.C.[280], and several bronze horse figures, cast mainly in Ionian workshops in the 6th century B.C.[281] have been identified.

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[277] C.C. Mattusch, 1980, 441; 1988, 120-121; 1988a; 1990a; D. Haynes, 1992, 48-49.

[278] H. Kyrieleis, 1984; C.C. Mattusch, 1988, 52-53; D. Haynes, 1992, 49, 55.

[279] W. Fuchs, J. Floren, 1987, 359-368.

[280] L.O.K. Congdon, 1981, 55-57.

[281] C.F. von Wangenheim, 1988, 22-27.

In the 7th century B.C. in Eastern Greece there also existed an independent centre for precious metalworking; the main finds of its output come from the Ephesian Artemision, where they were hidden under the altar basement. In articles from Ephesian workshops one can see the influence of Lydian and Phrygian art, and the most typical finds are pendants, earrings, pins and brooches. There has been discussion concerning the date of the altar, traditionally associated with the building activity of the Lydian king Croesus in ca. 560 B.C.[282]. However, recently an earlier date of ca. 600 B.C. has been proposed, which is very important for dating the beginning of Greek coinage[283]. Recently a further complex of gold and ivory articles was found in the basement of another cult building at Ephesus which allows us to adopt the date proposed earlier of ca. 560 B.C.[284]. The new finds from the Artemision, as A. Bammer has pointed out, stress the leading role of Lydia and Ionia in Archaic metalworking[285]. Ephesian craftsmen in ca. 570-550 B.C. probably executed chryselephantine sculptures of the Delphic triad and a silver bull statue in the sphyrelata technique dedicated at Delphi by Croesus[286].

A series of lead medallions, some of which originate from Delos and Chios, combine the motifs of Oriental art (North Syrian and Urartian) with those characteristic of Greek art. The term "Greco-Oriental lead medallions" is used for this group of objects, which was probably manufactured under Near Eastern influence in Asia Minor workshops from the late 7th to the mid-6th century B.C.[287].

Analyses of an early 7th-century B.C. cast bronze griffin protome and a late 6th-early 5th-century B.C. casting mould for jewelry, both from Miletus, suggest the work of resident Asia Minor or Syrian toreuts and jewellers here, who gradually adapted their products to Greek tastes[288].

## Magna Graecia

The local jewelry workshops of the Greek colonies of Sicily and Southern Italy were probably established in the 7th century

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282 R. Higgins, 1980, 118; B. Deppert-Lippitz, 1985, 92-97; D. Musti et al., 29-30.
283 See: C.G. Simon, 1986, 27-36.
284 A. Bammer, 1988; 1988a; 1990.
285 A. Bammer, 1988a, 247.
286 W. Fuchs, J. Floren, 1987, 394-395; D. Musti et al., 1992, 33-35, N 96.1-9.
287 See O. Brehm, 1992.
288 See E. Akurgal, 1992, 41; the detailed analyses see below on p. 162-163.

B.C.[289]. However, in P.G. Guzzo's opinion, the scarcity of finds makes it impossible to say definitely whether several gold objects found in Locri, Tarentum, Sibaris and Metapontum were produced locally[290]. In the late 7th—early 6th century B.C. a very characteristic style in bronze plastics emerged which stressed dominant features, giving liveliness and freshness to local bronze plastics[291].

## Sicily

The presence of metalworking at Selinus is proven by the recent find of a mould for casting a horse protome, dating to the last quarter of the 7th century B.C., a stylistic analysis of which gives reason to suggest a strong influence of the Corinthian style on products of the early Selinuntian workshops[292].

Probably as early as the first half of the 6th century B.C. and under the influence of Corinthian and Peloponnesian articles the production began of vases with figural attachments and decorations[293].

## Tarentum

The decisive influence on the formation of a Tarentine school of artistic metalworking was that of Sparta, the mother city of Tarentum. Bronze figures of the late 7th—early 6th century B.C. show the clear influence of the Laconian style. However, the complexity of defining the Tarentine school is explained by the fact that up to now no single statuette or bronze vessel in the Laconian style has been found in Tarentum. On the other hand, many bronzes were executed with a strong Ionic influence[294]. Almost one third of known Archaic bronze horse statuettes is attributed to Southern Italic workshops of 560-500 B.C.; one of the two figure groups, distinguished on the basis of stylistic analyses, including statuettes dated to ca. 560-550 B.C., is considered to be a product of the Tarentine workshop[295]. A statue of Zeus from Ugento is a masterpiece of Tarentine plastic art of ca. 530 B.C.: probably a sculptor

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[289] R. Higgins, 1980, 120; B. Deppert-Lippitz, 1985, 81; P. Guzzo, in D. Musti et al., 1992, 36-38.

[290] P. Guzzo, 1993, 132.

[291] C. Rolley, 1986a, 135.

[292] M.H. Fourmont, 1991, 11, N 2, fig. 5; 29-30.

[293] U. Jantzen, 1937; E. De Miro, 1976, 88-90; C.A. Di Stefano, 1990, 117.

[294] C. Rolley, 1986a, 126.

[295] P. Wuilleumier, 1968, 310-312; C.F. von Wangenheim, 1988, 70-91, 126-127.

from Tarentum was invited to carry out the order on the spot (however there is a view that holds a later date for the sculpture—up to the early 5th century B.C. and the use of craftsmen from the Laconian school); the attribution of the author is certainly difficult, N. Degrassi suggested that the hand was that of the Tarentine sculptor Eupides[296].

About 580 B.C. the Tarentine workshops began the manufacture of bronzeware: cauldrons with the recumbent figures of warriors, satyrs, maenads on their rims; hydriai of the Grächville type, monumental kraters with volute handles, decorated with Gorgon masks[297].

It is not absolutely clear whether reliefs were hammered in Archaic Tarentine workshops. A relief girdle with the figures of six ephebes on chariots and dogs is dated to ca. 570 B.C. and considered by U.Jantzen to be Tarentine. However, its closest comparanda are to be found among Corinthian bronzes[298].

### Epizephyrian Locri

The existence of local bronze-casting is proved by numerous finds of bronze articles from the town necropolis from the second half of the 6th century B.C.[299]. Under the influence of the Laconian school the production began in Locri of mirrors with figural handles, although the peak of their manufacture is restricted to the Classical period[300]. One could suppose that if not in Locri these mirrors were probably cast by workshops situated in other centres of Magna Graecia: Medma, Croton, and Tarentum[301].

### Sibaris

Until recently most of the bronze articles executed in the Laconian style were attributed to Tarentine workshops[302]. According to C. Rolley, the combination of elements of Laconian and Corinthian styles in the Vix krater and in some bronze hydriai from Paestum points to the existence of a further workshop of ca.

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296 N. Degrassi, 1981, 99-106; C.C. Mattusch, 1983, 409; 1988, 65-68; C. Rolley, 1986, 389-391; C. Rolley, 1986a, 41-42, fig. 16.

297 P. Wuilleumier, 1968, 329; C. Rolley, 1982, 95.

298 P. Wuilleumier, 1968, 321.

299 M.B. Bagnasco, 1989, 26, note 132.

300 F. Cameron, 1979, 56.

301 I. Caruso, 1981, 105.

302 H. Jucker, 1980.

540-520 B.C., which could not have been situated in Tarentum, but probably should be localized in Sibaris or Paestum; one cannot rule out the possibility that the workshop built on the traditions of a Laconian workshop, which ceased activity in ca. 530 B.C.[303]. Rolley also sees as a product of the same workshop the cauldron from Hochdorf, suggesting the following dates for the manufacture of the vases: the cauldron—ca. 540-530 B.C. and the krater—ca. 530-520 B.C.[304]. A group of bronze statuettes, imitating pieces from various artistic centres in Greece, is also attributed to the workshop of Sibaris[305]. The strongest influence was exerted by Ionic centres, primarily Miletus[306]. Bronze statuettes, dated to 500-480 B.C. and found at the Apollo sanctuary at Metapontum, were probably part of the output of a local workshop[307].

Numerous finds of helmets, belonging to the Lamia group of the Corinthian type and dating to the second half of the 6th century B.C., have been found in warrior graves in Rhegium, Zankles, and Locri, and give certain grounds for supposing that their place of manufacture was situated somewhere in that region[308]. It was most probably in the workshops of Magna Graecia in the last quarter of the 6th century B.C. that a new type of helmet, namely the so-called Chalcidian was created[309]. The output of the workshops of Magna Graecia was widely distributed throughout the barbarian periphery.

## Apulia

As early as in the first half of the 6th century B.C. the workshops of Apulia started the manufacture of Corinthian type helmets; a specific variant of these helmets often decorated with engravings was created there[310]. At the end of the century this changed into the so-called Apulo-Corinthian type[311]. One of the variants of the Italo-Corinthian helmet, the so-called Picenian, was produced in workshops in the central part of the Italian coast of the Adriatic[312].

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[303] C. Rolley, 1982, 95-96; 1986a, 144-150; 1987, 345-346.
[304] C. Rolley, 1988b, 99; 1990b, 363-364; 1993, 391-392.
[305] W. Fuchs, J. Floren, 1987, 432.
[306] C. Rolley, 1986a, 132.
[307] C. Rolley, 1989a.
[308] H. Pflug, 1988b, 94; cf. *Armi in Lucania*, 1993, 71-73, 83-84, 95-96.
[309] H. Pflug, 1988c, 138; see also *Armi in Lucania*, 1993, 135-136.
[310] H. Pflug, 1988b, 94-95, 98.
[311] A. Bottini, 1988; *Armi in Lucania*, 1993, 119.
[312] H. Pflug, 1988b, 95-96.

## Campania

C.F.von Wangenheim attributes to an "Etrusco-Campanian" workshop a bronze horse figure of the late 6th century B.C.[313].

## The Pontic area

### The Western Pontic region

Jewelry workshops, geared primarily toThracian clients, were probably established in the Greek colonies on the western Black Sea coast in the late 6th century B.C. For instance, a necklace from a tumulus at Muchovitse, perhaps made in such a workshop, is executed following the traditions of the Island jewelry school[314].

### The North-Western Pontic Area

Metalworkers, with shops in Olbia, Berezan and the Yagorlyk settlements, manufactured pins, bracelets, earrings, torques and other ornaments of the Scythian type, including some executed in the "animal style", as well as utilitarian objects and arrowheads[315]. The suggestion has often been made that mirrors with handles decorated with animal figures and cross-shaped plaques ornamented in the "animal style", were created by Olbian craftsmen[316]. At the same time, the results of spectral analysis seem to show that mirrors of the "Olbian type" and cross-shaped plaques could not have been manufactured in Olbia, and rather were imported from the western regions[317]. However, S.Ya. Ol'govskij's conclusion does not seem to be sufficiently well founded; the arguments for distinguishing an Archaic Olbian school of the "animal style" of the late 6th-5th century B.C. are fairly debatable[318].

It may be supposed, that in the Archaic period jewellers and toreuts were at work at the Berezan settlement. This is probably proved by a small hoard, consisting of coins and ornaments[319] and a bronze stamp with a male head of an oval shape in high re-

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313 C.F. von Wangenheim, 1988, 113.

314 B. Deppert-Lippitz, 1985, 122.

315 S. Ya. Ol'govskij, 1982, 14-15; N.A. Son, 1987.

316 See, e.g.: V.M. Skudnova, 1962; P. Oberländer, 1967; M.V. Skrzhinskaya, 1984; 1987.

317 S. Ya. Ol'govskij, 1982, 13.

318 A.S. Ostroverkhov, 1984; A.S. Ostroverkhov, S.B. Okhotnikov, 1989, 54-56.

319 P.O. Karyshkovskij, V.V. Lapin, 1979.

lief[320]. It is quite probable that this stamp was used for hammering applications in the form of masks for soldering onto phialai with omphali. Friezes of separately stamped masks in the shape of bearded heads decorate a pair of silver phialai of the 6th century B.C. in the Metropolitan Museum. The masks, as D. von Bothmer has stated, bear distinctly eastern features, which he determines to be Persian, bearing in mind a silver phiale, mentioned in the Delphic temple inventories[321].

### The Bosporan State

Stylistic analysis of Scythian sword scabbards of the 6th century B.C. has led N.A. Onaiko to assume that they were manufactured at a workshop in Pantikapaion[322]. This hypothesis was indirectly proved by the find at Pantikapaion of a casting mould used for making of sword endings. This bore the relief image of panthers in a heraldic scheme and can be dated to the third quarter of the 6th century B.C.[323]. Pantikapaion, like many other colonies of the Northern Pontic region, was founded by migrants from Miletus, although it is evident that natives of other Greek cities including craftsmen took part in the colonization process. Among them were probably residents of Ephesus; this is proven by the find at Pantikapaion of a fragment of an Etruscan infundibulum of the third quarter of the 6th century B.C. with a dedication to the Ephesian Artemis[324]. It is held that artistic metalwork was not especially developed in Pantikapaion's mother city, Miletus[325]. The identification of a so-called Milesian variant of the deep Achaemenid phialai of the second half of the 6th century B.C., which probably served as a prototype for Achaemenid bowls, is based on a stylistic analysis of a single bronze vessel from the museum of Miletus, whose origins are not well documented[326]. However, there is some evidence of local workmen, perhaps resident Oriental metalworkers, adapting their products to Greek tastes (see above on p. 70). This feature, which seems to be characteristic not

320 Ya.V. Domanskij, Yu.G. Vinogradov, S.L. Solov'ev, 1989, 52, fig. 14, 6.
321 D. von Bothmer, 1984, N 16-17.
322 N.A. Onajko, 1966.
323 M.Yu. Treister, 1988, 45-48.
324 M.Yu. Treister, 1990a; 1990b; 1991a.
325 W. Fuchs, J. Floren, 1987, 389.
326 See: M. Pfrommer, 1986. See a discussion about centres of manufacture of the "Achaemenid bowls": M. Pfrommer, 1987, 213-245; cf. L. Byvanck-Quarles van Ufford, 1991; cf. M. Pfrommer, 1993a, 345 ff., Anm. 49.

only of Archaic Milesian metalworking, but in general of that of other Greek cities of Asia Minor and Levant, explains, in my opinion, the rapid adaptation of craftsmen who had migrated to the Northern Pontic area to the tastes of the Scythian population. Ephesus was perhaps the most significant centre for precious metalworking among Ionian cities in the first half to the middle of the 6th century B.C. (see above on p. 70) and one maintained by the migration of metalworkers from Ephesus. The migration of the metalworkers from other Greek centres, including Crete, to Bosporus is proved by a graffito on a conical object from the third quarter of the 6th century B.C., found at Hermonassa, which may had been used as a bellows nozzle[327].

### *2.2.3. Metalworking in the Period of Greek Colonization*

#### *2.2.3.1. General Characteristics*

What forms did metalworking take in the Geometric and Archaic periods?

Homer mentioned palace craftsmen and wandering *demiurges.* At the main sanctuaries permanent workshops existed[328]. While evidence of metalworking at sanctuaries in the Late Geometric period may not seem at all copious, it is nonetheless present in the archaeological material in the form of debris from the production of castings, tools and implements used in the manufacture of weapons and other metal products. The few traces left by workshops at sanctuaries are, in Ch. Risberg's opinion, probably due to the fact that they were not very stable constructions, intended, as they were, only for temporary use. However, it seems likely that the relative paucity of archaeological data may be in many cases explained by the extensive rebuilding that took place in most Greek sanctuaries in later periods, a reason, which has been also suggested by Ch. Risberg[329]. I would prefer to agree with those scholars, who maintain that from the 8th century B.C. onwards, there is clear evidence that sanctuaries were becoming increasingly important centres of craft production, and especially of metalworking[330]. Who were the craftsmen, who worked the metal at the sanctuaries and what relation, if any,

327 M.Yu. Treister, F.V. Shelov-Kovedyayev, 1989.
328 J. Boardman, 1978, 26-27.
329 Ch. Risberg, 1992, 39.
330 C. Morgan, 1993, 23f.

did they have to the sanctuary? The idea of independent, itinerant craftsmen setting up shops temporarily at the various sanctuaries seems to be the explanation favoured by most scholars who have discussed this question[331]. In this connection we should note a remark by A. Jonston concerning the find of a weight at Pithekoussai and the interpretation of lumps from a jeweller's hoard at Eretria of 5.7 and 112 gr. as being on the Euboean standard: "The artisan must have been independent of his customers. If he were in a client position, there would be no obvious reason why he should produce jewellery conforming to any given standard"[332]. However, it is held that metalworking for festivals was not a full-time job[333].

A number of questions remain as to who supplied the metal to be worked—the craftsmen himself or the prospective customer? The latter situation is a system which is known from other cultures. Ch. Risberg puts forward a hypothesis that there may even have been some sort of central agency issuing metal, as may have been the case in Mycenaean times[334]. However this sounds improbable to me and hardly ties in with the existence of wandering craftsmen.

In an *oikos* type of economy almost all production, and many of the craftsmen as well, were part of an integrated economic system and no payment was required. However, can one maintain that this type of economy functioned in the Late Geometric period? Ch.G. Starr supposes that in this period craftsmen had their own independent niche in an agricultural economic system[335]. A considerable volume of craft output in the Homeric period was manufactured directly in peasant houses. Professional craftsmen, or *demiurges*, were invited only in case of the most complicated and largest orders, including metalworking jobs[336]. The demand from the upper classes and the temples for luxury items was satisfied by craftsmen, who could not be limited to a particular *oikos*. No one aristocratic family, on the other hand, could provide full employment to an armourer; also fairly impersonal were the needs of the religious structures in early city-states. This led to the greater independence of craftsmen and to their further specialization[337].

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[331] W.-D. Heilmeyer, 1969, 2f., 21; 1979, 52; M.J. Rowlands, 1971, 214; C. Morgan, 1993, 23.

[332] *The Greek Renaissance*, 1983, discussion, 165.

[333] C. Morgan, 1993, 23.

[334] Ch. Risberg, 1992, 39.

[335] Ch.G. Starr, 1977, 81. See also C. Morgan, 1993, 23

[336] L. Neesen, 1989, 25.

[337] Ch.G. Starr, 1977, 81; J.N. Coldstream, 1977, 311.

An analysis of the spatial distribution of the material and of the numerous peculiarities of its manufacture, undertaken by J.-L. Zimmermann, proves that by the mid-8th century B.C. each region of mainland Greece had its own bronze workshops. They were dependent on the sanctuaries and sold the principal types of bronze figures to the big cities. The output of six production regions was transported outside their borders. Many workshops, but not those of Crete, Elis and Northern Greece, worked mainly for sanctuaries situated outside their own regions.

Towns played a prominent role in the technical and artistic developments of the Geometric period by establishing a metalworking infrastructure. Thus, at Olympia not only were local craftsmen working, but so too were craftsmen from other regions of the Peloponnese. One could suggest that craft specialization was much more developed in the Geometric than in the Mycenaean period, although a strict division of labour did not exist.

The number of craftsmen, employed in workshops, was rather small. However, they were able to transmit local traditions to following generations of craftsmen. In time some of them were replaced by wandering masters, who met up at the large interregional sanctuaries during festivals, religious ceremonies and sporting events. The competition, which existed at Olympia, following J.-L. Zimmermann's suggestion, stimulated the development of Peloponnesian metalworking.

Most local production is characterized by interrelations, the rapid borrowing of technical and stylistic innovations, and constant adaptation to changes in tastes. Modern ideas of supply and demand cannot be extrapolated to this period, however it is possible to state that craftsmen worked primarily to meet the needs of an aristocracy[338].

The conclusions of J.-L. Zimmermann about the spatial distribution of bronze-workshops in Greece in the Late Geometric period are confirmed by analysis of later Orientalizing cauldron attachments. According to O.W. Muscarella, 57 of 88 siren cauldron attachments derived from the Greek world, and of these 57 examples, representing an estimated 47 to 49 cauldrons, about 45% (26 protomes of about 21-23 cauldrons) are of Greek manufacture. The 45% figure indicates both a more intense degree of local copying and, perhaps, a larger number of Greek workshops in

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[338] J.-L. Zimmermann, 1989, 308-309, 332-333.

existence in the late 8th and early 7th centuries B.C. than previous studies had suggested[339].

F. Shachermeyer, in evaluating Athenian crafts at the time of Peisistratos, stated that there had been separate workshops with small numbers of workers, but with developed connections, although it is not possible to maintain the existence of large-scale factories and industry in the period in question[340]. The absence of large workshops in the Archaic period is also asserted by G. Glotz[341]. This view is also the one prevailing at present. For example, J.B. Salmon assumes that in all the cities and, also perhaps, in the major settlements there existed small private workshops with an undifferentiated type of output[342].

G. Glotz stated that unlike craftsmen with other specialisations, who may have worked with their tools in a client's house, the specific nature of smithing (to a far greater extent than that of toreutics or bronze founding) demanded the organization of a workshop[343]. The isolation of metalworkers in the structure of early Greek settlements is proved by the quarter excavated at Pithekoussai, the inhabitants of which were engaged in the treatment of various metals. In the late 6th century B.C. a similar quarter existed in Pantikapaion.

D. Ridgway has assumed that the peripheral location of the industrial complex at Mezzavia, which he has designated as "suburban", is precisely what we should expect, because early smiths needed to be near to the sources of the charcoal that they used in vast quantities, and their fellow citizens were doubtless anxious to avoid the risk of fires and the certainty of malodorous smoke in the main settlement[344]. However, it is unlikely, especially in view of practices which existed in the Classical period (see below on p. 194), that restrictions were already being placed on the siting of metalworkshops in Late Geometric times. I. Morris argues for the idea of an "ironworking quarter" at Mezzavia, stating that one of the structures there was definitely domestic and that ironworking slag was also found in the main settlement area. The material record does not allow us to distinguish with any confidence between full-time and part-time specialists, and full-time artisans could of

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339 O.W. Muscarella, 1992, 20-21.
340 F. Schachermeyer, 1937, 127.
341 G. Glotz, 1926, 131.
342 J.B. Salmon, 1984, 119.
343 G. Glotz, 1926, 46-47.
344 D. Ridgway, 1992, 92.

course live in their workshops; but there is little to suggest a concentration of industrial activity in special districts before the late 6th century. I. Morris maintains that by the late 6th century many centres would have had some full-time potters and metalworkers, even if some areas of production were monopolised by a single polis, and small parts of many cities were probably given over to workshops. However, craft production remained on a very small scale, probably as a part-time household operation[345]. Perhaps there were various models for the spatial grouping of metalworkshops in town structures. Observations of the organization of ceramic production in Archaic and Classical Athens and Corinth show that they differed in the details of manufacture, the location of workshops, and the scheme for the distribution of finished products[346]. The Yagorlyk settlement, which may have been a seasonal camp for craftsmen from Berezan, situated close to supplies of raw metal and fuel, is an example of a specialized craft settlement, where objects in various metals and glass were manufactured[347].

To judge from excavated constructions with the remains of metalworking which date from the 8th-6th centuries B.C., workshops in Pithekoussai, Corinth, and Pantikapaion with an undifferentiated type of production[348] and those that were probably specialized, e.g. in the manufacture of armour, were usually small, occupying houses of 1-2 rooms. The number of workers employed was, thus, also fairly small, usually not more than 10. By comparison I shall mention some data concerning the Archaic production of ceramics.

According to I. Scheibler, large Late Archaic pottery workshops employed 30-40 workers, while those producing painted vases used up to 100-200 including slaves and assistants[349]. Scheibler distinguishes three categories of workshop: 1) those with one potter; 2) "family" workshops with 2-5 potters; 3) big workshops with up to 5-10 permanently employed potters[350]. According to other opinions, based on analyses of representations of pottery workshops on vases and archaeological data concerning ceramic manufacture at Athens and Corinth, approximately 6 workers were engaged in a workshop, i.e. an "extended family". The technical skills were trans-

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345 I. Morris, 1991, 38-39.
346 K. Arafat, C. Morgan, 1989.
347 A.S. Ostroverkhov, 1989, 96.
348 G. Zimmer, 1990, 24.
349 I. Scheibler, 1984; cf. M. Eisman, 1987.
350 I. Scheibler, 1984, 130-131; E. Kluwe, 1989, 418-419.

mitted within such workshops from one generation to the next. Two long constructions excavated in the Corinthian Kerameikos were originally interpreted as a factory divided into a row of workshops, however, these edifices were separate houses rather than a specially planned building complex with pits in the yards for the storage of clay or counters for selling vases[351].

The growth of Archaic Greek crafts depended not on the capital invested in the workshops, but rather on technological improvements. The costs of equipment and materials were not significant and sometimes, for instance, with jewelry, craftsmen could work with materials provided by clients[352].

Ch.G. Starr, in estimating the number of people engaged in pottery manufacture in 6th-century Athens, assumes that there were no more than 150 and, on the whole, the number of workers employed in Athenian craft industry, including metalworking, masonry, wood, leather treatment etc. did not exceed 1000[353].

The working patterns of foundries and sculpture workshops differed from those of potters and vase painters. While the production of the latter was to a considerable extent geared towards building stock for supply, metalworkers, to go by a suggestion made by H. Philipp[354], worked primarily to order. It is difficult to determine whether a sculptor or a founder had permanent apprentices. A craftsman may have been at the same time the owner of a workshop and a workshop may have had two owners—the fact that the names of Kritios and Nesiotes are mentioned only together and only inscribed on the bases of statues may indicate that they were joint-owners of a workshop in Athens. On the other hand, other craftsmen with frequent orders in various towns, could not have employed permanent assistants.

For the production of certain categories of bronze utensils of the 6th century B.C. one can suppose the existence of stable permanent workshops located at the main polis centres and geared to meet a steady demand. Such stable stationary workshops, judging by the analysis of cauldrons with palmette attachments from Olympia, existed for longer than one generation of craftsmen and guaranteed the continuity of craft tradition. W. Gauer maintains that besides cauldrons, some other types of bronze utensils, like hydriai, as well as mirrors, were manufactured in such workshops. At the same

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351 K. Arafat, C. Morgan, 1989, 317-328.
352 Ch.G. Starr, 1977, 82.
353 Ch.G. Starr, 1977, 104.
354 H. Philipp, 1990, 90-91.

time, as in earlier periods there existed temporary workshops, manufacturing bronze vessels, at the pan-Hellenic sanctuaries, which moved from sanctuary to sanctuary. Some of these workshops satisfied the demand of the barbarian hinterland, moving, for example, from Laconia to Lydia, and from there to Italy etc.[355].

### *2.2.3.2. The Division of Labour and Specialization of Crafts*

The division of labour between the various branches of metalworking is not very clear in the 8th century B.C. For example, Hephaistos is mentioned in the "Odyssey" both as a smith, as an armourer and as a toreut[356].

Analysis of a Geometric bronze mirror from Berlin led G. Zimmer to the conclusion that the matrices used, for example, for the manufacture of tripod legs may have been used in various combinations in the production of smaller objects, for instance, mirrors or small figurines. Such a "technological transfer" was not impossible in the Geometric period with its undeveloped division of labour[357]. At the same time the find of an 8th-century B.C. jeweller's hoard in Eretria[358] gives reason to suppose that some specialization in metalworking had already taken place. For the Late Geometric period it is perhaps possible to propose the beginning of such a division. For instance, it is thought that in Argos in the mid-8th century B.C. the manufacture of tripods and votive figures was divided over different workshops, although these may have cooperated. Perhaps, there were also workshops specialized in various kinds of votive figures[359]. However, in Laconian workshops the same craftsmen, e.g. "the master of the New York centauromachy", cast not only statuettes of horses, but of other animals as well[360]. The remains of workshops, dating from the 7th and 6th centuries B.C., unearthed in Corinth and Pantikapaion respectively, can only be described as armouries in a relative sense. According to P.C. Bol[361], the foundations of a deeper specialization in the manufacture of arms and armour were laid in the Archaic period, when craftsmen appeared who specialized in the production of helmets (*krano-*

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355 W. Gauer, 1991, 169 ff.; cf. C. Rolley, 1993, 394.
356 See: G. Glotz, 1926, 26-27.
357 G. Zimmer, 1991, 19-20; U. Höckmann, 1994, 374.
358 P.G. Themelis, 1983.
359 See: J.-L. Zimmermann, 1989, 52, note 267.
360 J.-L. Zimmermann, 1989, 167.
361 P.C. Bol, 1985, 49.

*poioi*), cuirasses (*thorakopoioi*), shields (*aspidopegoi*), swords (*xiphopoioi* and *macheiropoioi*), and spears (*lonchopoioi*). Although the names of professions given above were only established in the Classical period, the process of specialization undoubtedly began in the previous era, already in the last third of the 7th century B.C. This is also confirmed by the desire of craftsmen to decorate their articles. For example, there were ca. 300 various ornamental patterns for the decoration of shield overlays. Both from a technical and artistic standpoint the Archaic era was a period in which the manufacture of Greek armour flourished[362].

In the 6th century B.C. temporary workshops appeared such as the casting pits for the making of sculptures known from Athens and Corinth[363]. As regards construction there is an absolutely similar pit with the remains of production in the Samian Heraion in which was found a bronze cauldron with a dedication of Brychon[364]. There are probably no grounds for determining the find as the remains of a permanent workshop at the sanctuary, as some scholars have done; more correct seems to be the interpretation of the production remains as those of a temporary workshop for casting statues[365]. To the category of temporary workshop belongs probably the remains of a Phanagorian workshop of the late 6th century B.C. with the debris of a furnace and fragments of a mould for a sculpture[366]. However, the process of specialization in metalworking could not make much progress during the Archaic period. A tradition, preserved by ancient writers, describes the craftsmen of the 6th century B.C. as versatile masters, often working at the same time as architects, bronze founders, toreuts etc.

If Telesstas, whose name is inscribed on the rim of a bronze hydria of the first quarter of the 6th century is the same person as a bronze sculptor of the same name, who made a bronze statue of Zeus for the people of Kleitor in Arcadia, as a dedication to Zeus at Olympia, mentioned by Pausanius (V.23.7), as some scholars have suggested[367], then we have a rare example of the correlation of archaeological data and literary tradition.

Just recently a hypothesis has been put forward that already in the Late Archaic—Early Classic period (at least not later than 530

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362 P.C. Bol, 1985, 61, 64.
363 C.C. Mattusch, 1977; 1977a.
364 G. Schmidt, 1972.
365 G. Shipley, 1987, 88-89.
366 V.S. Dolgorukov, 1986.
367 E. Diehl, 1964, 5; C.M. Stibbe, 1992, 12.

B.C., if one adopts the date of the krater from Vix, proposed by B.Shefton; see above), a system for the division of labour between workshops of different centres began to take shape, even if in an embryonic form. V.P. Vasilev's interpretation[368] of the letters engraved on parts of bronze vessels supposes that they had been transported in disassembled form by sea and assembled at the end point of their sea journey (for details see below). This hypothesis gives a reason to consider the possibility that chains of production existed. At the same time, these interesting and subtle observations, although based on a rather limited group of vessels[369], hardly give grounds for extending this supposed system of transportation to those vessels, which have no letter marking, as V.P. Vasilev does (see below on p. 116 f.). Thus, it may be argued that the division of labour between workshops in different centres if it ever occurred in the Late Archaic period, existed for a short period and only developed further in the Hellenistic period. In view of the provenance of the finds discussed from Trebenishte, Staro Selo, and Vix, the workshops of Laconia, Corinth or Magna Graecia may have been such centres. On the other hand, Vasilev's hypothesis is not above dispute. For instance the krater from Vix, which has a weight of 208.6 kg, has no letter markings on its handles, each of which weigh ca. 45 kg. Their separate transportation would considerably facilitate the conveyance of the krater. On the other hand, the dismantling of appliques, which have such markings, produces quite a small reduction in weight but considerably complicates the work of assembling the vessel. According to M. Maass, the Vix krater was quite transportable even if not dismantled[370]. P.C. Bol supposes that the transportation of large bronze vessels, including those with bodies hammered from thin metal sheet, was a complicated, although not impossible task, and maintains that cauldrons with protomes of Eastern manufacture were delivered not only to Olympia and Delphi, but in Italy as well, as long ago as in the 8th-7th centuries B.C.[371]. To my mind, the system of letter marking of separate parts of big vessels was rather a reflection of the division of labour within one

[368] V.P. Vasilev, 1983; 1988, 117.

[369] The group of vessels with letters marking will grow in case of special study of bronze vessels, primarily Archaic volute kraters, as it supposed by B. Shefton, 1989, 219, Anm. 54). It is proved, e.g. by the recent find of such letters in course of restoration of the late 6th century bronze krater from Munich. See: M. Maass, 1983.

[370] M. Maass, 1983, 5-6, Anm. 8.

[371] P.C. Bol, 1985, 34.

workshop, which is clearly shown by a study undertaken by V.P. Vasilev himself[372]. C. Rolley has also recently come to a similar conclusion[373].

The analysis of the techniques employed in manufacturing a krater from the grave I of the Trebenishte necropolis proves that there was a model of the finished vessel in the workshop. Plastic decorations, like handles and appliques, were executed by a skilled craftsmen. Their positions on the vessel were exactly defined. Negative models were made from these pieces which could later be used for casting the required number of positive waxes used in lost-wax casting. Models of complicated handles were divided into separate negative moulds. These parts were cast separately and then soldered. The working procedure was thought through in detail in advance. That is proved by the exact positioning of the rivets already on the negative mould. After polishing, the surface of the vessels was decorated with engravings, which were executed by the craftsmen of different skills with various individual abilities. So, the style and quality of the engraving of both handles of the krater give reason to suggest that they were undertaken by two different craftsmen: one of them, the more skilled, was enthusiastic in engraving the small details; while the other, who had not yet mastered the skills of coldworking, avoided doing the delicate patterns. Six appliques in the shape of cows were made, to judge by the details of the engraving, by at least three masters. Analogous observations were made on a krater from grave VIII from the same necropolis. The appliques on the krater were executed with the help of one negative mould, although they were engraved by different craftsmen[374].

P.C. Bol has come to independent conclusions concerning the division of labour in Archaic metalworking shops after analyzing similar statuettes of a recumbent Satyr from Olympia, which perhaps were decorations of a bronze krater. In his opinion, within a single workshop one craftsman prepared a wax model, while other craftsmen cast the figures and engraved them, each making his piece from the beginning to the end of the process. This division of labour is also found in the casting of Classical bronze sculptures[375].

It might be assumed that the craftsmen who made the wax

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[372] V.P. Vassilev, 1990.
[373] C. Rolley, 1990a, 420.
[374] V.P. Vasilev, 1988, 114-115.
[375] P.C. Bol, 1985, 110-111.

models were at the same time engaged in carving marble sculptures. For instance, the eyes inserted in the horse figures of the Gigantomachy frieze of the Apollo temple at Delphi demonstrate, in B.S. Ridgway's opinion, the bronzeworking traditions of that workshop[376].

The development of mass production techniques in the manufacture of metal objects—component moulds and matrices—led to the growth of the serial production of the same pieces and to a division of labour both within the workshop and between workshops in the same centre. Worthy of attention is a bronze mirror from the Antikensammlung, Staatliche Museum Preussischer Kulturbesitz in Berlin: its handle is decorated with a stamped relief with a depiction of Priam before Achilles which is typical of the decoration of shield overlays. The suggestion that craftsmen making mirrors and an armourer were working in one big workshop with a wide range of skills is not realistic, according to P.C. Bol, for the Archaic period. He finds an explanation in the industrial structure of the Greek town, where the metalworkers, like the potters for example in Athens, had settled together in one neighbourhood in the vicinity of the temple of Hephaistos; as a result their tools and models readily passed from one hand to another[377]. That the mass production of series of bronze objects took place is proved by the fact that already in the 7th century B.C. identical sets of wax casts were used for making griffin protomes for the decoration of Orientalizing cauldrons. These wax casts provided a certain dimension and style, necessary for the decoration of a single cauldron, but at the same time preserved the individual features of the bronze castings. This technique is better described as "repetition" rather than as copying or reproduction[378].

### *2.2.3.3. Migrations of Craftsmen*

What models exist for a metalworking shop of the 8th century B.C. situated at a Greek sanctuary? The most reliable reconstruction can be made on basis of published materials from Olympia: of more than 4000 bronze animal figures more than two-thirds—and in the early period even 85%—were the products of local Elean workshops. Among the local craftsmen were not only founders, specialized in casting votive objects, but smiths as well. The size of these workshops

[376] B.S. Ridgway, 1977, 208, note 29.
[377] P.C. Bol, 1985, 91. See also G. Zimmer, 1991, 13-15, Abb. 11.
[378] C.C. Mattusch, 1990; 1990a.

may be disputed, however they can most probably be described as of "family size". Alongside local craftsmen so-called wandering masters were at work, and the most important of these were those who originated from Argos—their workshops had already appeared in the 9th century B.C.—and from Laconia, which produced about a quarter of all the figures found in Olympia[379]. However, it cannot be ruled out that the actual distribution was rather different, because W.-D. Heilmeyer has studied only one fourth of the known material in his catalogue[380]. According to J.-L. Zimmermann's calculations, about 43% of the Geometric horse figurines found at Olympia were imported or cast in non-Elean workshops[381].

It is worth noting that all Laconian-type votives can be dated, according to W.-D. Heilmeyer, to the rather narrow period of 775-740 B.C. It is argued that Laconian craftsmen may have been only *perioikoi,* free, although deprived of Spartan civic rights. In Laconia proper, which had an agricultural structure, craft industry never really took root at Sparta, but developed in the regions inhabited by *perioikoi.* Examples of similar craft settlements with the character of a town were Pithekoussoi and Thorikos in Attica. It is thought that at the start of the First Messenian War in 743/42 B.C. the *perioikoi* left Olympia to come back to Sparta; their return thus showed that they had maintained relations with their homeland[382]. P. Cartledge, who is rather sceptical of Heilmeyer's hypothesis, declares himself perplexed; why are no finds of a similar period known from Laconia and why did those Laconian craftsmen, who had packed their bags in ca. 740 B.C., not return to Olympia after the end of the war?[383]. It seems that an answer to the first question is contained in the hypothesis stated above, while the reasons for failure of the craftsmen to return are debatable. Why not assume that these wandering craftsmen went to the colonies established by the Spartans in Magna Graecia, where metalworking showed the strongest influence of the Laconian style?[384]. A more detailed critique of the historical reconstructions made by W.-D. Heilmeyer is given in H.-V.Herrmann's review[385]. He argues that it is possible to give exact datings, based on the stylistic observations of

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379 W.-D. Heilmeyer, 1979, 137, 275.
380 See the critics: H.-V. Herrmann, 1982, 617-618.
381 J.-L. Zimmermann, 1989, 63-64.
382 W.D. Heilmeyer, 1979, 192-194.
383 P. Cartledge, 1982, 290.
384 Cf.: J.-L. Zimmermann, 1989, 171, note 422.
385 H.-V. Herrmann, 1982.

Heilmeyer,, as well as historical dates, for example 776 B.C. as a beginning of the Olympic Games, and 743/42 B.C. for the start of the First Messenian War, where both traditions are to a large extent legendary. A more convincing dating for the First Messenian War, as J. Zimmermann maintains, lies between 735/30 and 715/10 B.C.[386]. Moreover, unlike P. Cartledge, H.-V. Herrmann is interested in the reasons for the return of the Laconian craftsmen to Sparta, which had not been explained by the author of the hypothesis[387]. Finally, J.-L. Zimmermann presented a new classification of bronze horse figures from Olympia, which led him to uphold parts of W.-D. Heilmeyer's hypothesis[388]. He dates the production of the Laconian, Arcadian and Messenian craftsmen at Olympia to a somewhat earlier date than does Heilmeyer, i.e. to the end of the first quarter of the 8th century B.C.[389], but maintains at the same time that there was a reduction in the production of Laconian bronzes at Olympia in ca. 740 B.C.[390].

However C. Rolley, in discussing Zimmermann's observations, holds that Heilmeyer's classification is closer to reality[391].

It is difficult to say whether the Laconian craftsmen working in Olympia were *perioikoi*. In any case, A.M. Snodgrass considers that the Spartan social system was established not before the 7th century B.C.[392]. P. Cartledge thinks that from at least the 7th century B.C. on *perioikoi* played a leading role in Laconian metalworking, especially in the manufacture and repair of arms and armour, which, at the same time, does not exclude the possibility that metalworking shops existed not only in their settlements, but in Sparta as well[393].

While I agree that Heilmeyer's historical interpretations are debatable, I would note that the main thrust of his hypothesis—the

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[386] See: J.-L. Zimmermann, 1989, 174, note 448. Most recently the dates of the First Messenian War were once more discussed by V. Parker, who came to the following conclusion: our only evidence for dating of the War to the second half of the 8th century is Pausanius, who has based his account on a worthless source. More convincing are the arguments in favour of the lower dates, i.e. ca. 690-670 B.C., or, perhaps 710-690 B.C. (see V. Parker, 1991, 42).

[387] H.-V. Herrmann, 1982, 614, 617.

[388] J.-L. Zimmermann, 1989, 63-65.

[389] J.-L. Zimmermann, 1989, 88-90.

[390] J.-L. Zimmermann, 1989, 171.

[391] C. Rolley, 1991, 282.

[392] A.M. Snodgrass, 1980, 88.

[393] P. Cartledge, 1979, 184-185.

formation of a group of craftsmen within the social structure of a society, the temporary character of their workshops (wandering craftsmen), their work in a major religious centre,—seems quite probable. The possibility cannot be excluded that bronze founders from Corinth and Sparta worked in the Samian Heraion as well as at Olympia. The absence of finds of Corinthian and Laconian clothing decorations and ornaments at the Heraion give no reason for rejecting such a possibility; although, on the other hand, the finds of pins and pendants—which are typical of the Peloponnese as a whole—speak in favour of the presence of Peloponnesian visitors at the Heraion[394].

P.C. Bol thinks that during the major festivals, particularly the Olympic Games every four years, craftsmen from various parts of Greece came to the sanctuaries and installed their temporary workshops with the idea of selling products made on the spot in the presence of their customers. These could be small votives such as statuettes, or large ones: a cauldron or a tripod. In a latter case the work could not have been completed during the rather short duration of the festival, therefore the customer would have had to wait for some time after its end. That such intricate orders were carried out at Olympia is proved by the find of a mould fragment for casting a tripod[395]. However, the lack of miscastings and casting debris attributable to the production of tripods rather suggests that during the 8th century B.C., unlike figurines, tripods were most probably brought to Olympia from workshops elsewhere (we have just one mould and one miscasting of this, and evidence in quantity appears only from the 7th century B.C. onwards)[396]. At the same time, one should not simplify the ease of movement of wandering craftsmen. Although the results of clay analyses of casting moulds provide at present no basis for firm conclusions, it cannot be ruled out that when he moved to Olympia or Delphi, a craftsman took with him—along with his instruments—clay of a certain composition and consistency which he was accustomed to use for his casting moulds[397].

The model proposed by Heilmeyer cannot be considered to be universally applicable to the whole of Greece. This is clearly shown

[394] I. Kilian-Dirlmeier, 1985, 237.
[395] P.C. Bol, 1985, 22, 34-36.
[396] W.-D. Heilmeyer, G. Zimmer, G. Schneider, 1987, 266-268; C. Morgan, 1993, 24.
[397] P.C. Bol, 1985, 128.

by the conclusions reached by I. Kilian-Dirlmeier which are based on a study of imported votives found at various Greek sanctuaries of the 8th- early 7th centuries B.C.[398]. In her opinion, the total picture of the distribution of offerings found at a rural sanctuary in Thessaly gives grounds for supposing that all localities in Greece had their own workshops, which were able to meet regional needs for details of clothing and ornaments. This is also true of bronze statuettes, so the hypothesis that wandering craftsmen worked in workshops at Olympia cannot be universally applied to Greece. On the contrary, the technically intricate manufacture of tripods and cauldrons with griffin protomes should be probably limited to three centres of production: Argos, Corinth and Athens, which means that such objects found their way into other regions as the result of trade, exchange or gifts. However if the male figure from Kalapodi with a miscast was a detail of a tripod, as R. Felsch has asserted, one can suggest that they were produced in Phocis as well. Similarly, going by the current state of knowledge, armour, particularly early types of helmets, was virtually the product of two centres: Argos and Corinth. If this view is to remain true, then the supply of armour to other Greek localities depended on the output of the two centres mentioned above and on trade[399].

Signatures on the bases of statues—a widespread practice from the 6th century B.C. onwards—form an extremely valuable source for tracing migrations of craftsmen. The following data give an idea of the level of mobility of sculptors. According to J. Boardman's calculations, at least one third of 24 sculptors, whose names are known from inscriptions found on the Athenian Acropolis and necropoleis, were immigrants, for example Gorgios of Sparta, Kallon and Onatas of Aegina, Evenor of Ephesus, and Bion of Miletus; and wandering craftsmen were engaged primarily in making the votive objects found on the Acropolis[400]. The Cretan craftsmen, Dipoines and Skill, "the pupils of Daedalos" worked at Sicyon: it is thought that they were attracted by the artistic reputation of Sicyon rather than specially by the Sicyonians[401]. The reason for their departure from Sicyon was supposedly rivalry with local sculptors, however there is no firm data for their existence: Kanachos and Aristokles belonged to the generation after the pupils of Dipoines and Skill.

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[398] See: I. Kilian-Dirlmeier, 1985.
[399] I. Kilian-Dirlmeier, 1985, 219-220.
[400] J. Boardman, 1978, 74; cf. B.S. Ridgway, 1977, 286.
[401] A. Griffin, 1982, 112.

Thus, the most probable reason for their departure was a reduction in artistic activity in Sicyon as a result of the decay of the tyranny and the loss of Clisthenes' generous patronage. After that Dipoines and Skill probably stayed at Sparta—at least they had several pupils there. They then returned to Sicyon and afterwards went to Argos[402]. Ch.G. Starr thinks that on the whole the reason for the migration of craftsmen in the Archaic period was the lack of qualified masters; on the other hand, skilled craftsmen could not live from the orders which they received from one town alone[403].

Besides wandering sculptors and founders, in the 6th century B.C. there were also itinerant workshops of toreuts who manufactured richly decorated bronze ware. W.Gauer designates these workshops as the "*wandernde Elite*", assuming that they were to a certain degree pan-Hellenic and suggesting that occasionally craftsmen of various origins worked together in such workshops. However, these itinerant workshops did not lose their links with their mother cities, even when they were looking to the future for a new permanent location. Itinerant workshops were established, in Gauer's opinion, not only at Greek sanctuaries. It is asserted that they also satisfied the demands of a barbarian hinterland for luxurious Greek bronze vessels, like those found in Celtic, Thracian and Scythian tumuli. These itinerant toreuts may in part have been the same as those who worked at the Greek sanctuaries. Analyzing finds of hydriai of the Telesstas group found in Italy and Sicily and considering the fact that products of the Laconian Telestass-workshop were imitated in both Southern Italy and Epirus, W.Gauer assumes that this workshop, or craftsmen attached to this workshop, made a short stay at for instance Dodona or Paestum or Cumae. He also suggests that during this stay in Southern Italy one of these craftsmen, or even the whole workshop, set up a permanent atelier, presumably at Tarentum. Furthermore, Gauer maintains that the Lydian king Croesus may have been a prototype barbarian customer, ordering a famous krater, which he associates with the production of the so-called workshop of the "*Lakonier-Kessels*". The fall of the Lydian Kingdom in 546 B.C., thus, according to Gauer, forced the Laconian wandering craftsmen working for Croesus to look for new markets. The master of the Vix krater is held to be one of these craftsmen, who may have worked for some time at Tarentum (or

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402 A. Griffin, 1982, 114-115.
403 C.G. Starr, 1977, 88.

Sibaris or Cumae or Paestum)[404]. The suggestion that Laconian craftsmen migrated to Italy in the mid-6th century B.C. is confirmed by B. Shefton's analysis of a type of Etruscan bronze oinochoai, the so-called Recanati Group. Shefton maintains that whereas several generations earlier the prevailing influence seemed to have emanated from Eastern Greece in the shape of the "Rhodian Bronze Jugs", now the influence come from the Peloponnese, particularly from Laconian production. A little before the middle of the century, a shortlived local workshop seems to have sprung up in the North East of Italy along the Adriatic, which was brought into being by substantial imports of Laconian bronze vessels[405].

*2.2.3.4. The Place of Metalworkers in the Social Structure of Society*

Craft activity was concentrated to a considerable extent in the hands of foreigners, metics, in many of the Late Archaic Greek city-states. The institution of *metoikia* was established in the late 6th century B.C. in Athens, and the reasons for its appearance were probably connected not with the development of craft and trade, which were stimulated to grow, but with the process of internal evolution of the *poleis.* It is thought that the traditional prevalence of foreigners in Athenian pottery industry goes back already to the Geometric period. The formation of a stratum of craftsmen took place then not among the local population, but among immigrant groups as in other Greek cities (cf. Arist. Pol. III, 3, 2)[406]. Industrial activity was considered to be less prestigious than agriculture[407]. It is terminologically more correct to define metics not as "quasi-burgers", but as "anti-citizens". The formation of the institution of *metoikia* was a gradual process with a prehistory in the Archaic period[408]. It may be argued that in the case of metalworking the formation of this institution reflects the emergence of itinerant craftsmen in the 8th-6th centuries B.C. Already in pre-Solonian times there were sporadic cases of grants of Athenian citizenship to *demiurges* (cf. Plut. Sol. 24, 2; Arist. Pol.1278a3-30). Wheres under an aristocracy craftsmen do not belong to the citizen body, under an oligarchy their adoption was occasionally possible. In any case, it is known that one of the Solonian laws

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404 W. Gauer, 1991, 170-173.
405 B. Shefton, 1992, 153-154.
406 V.P. Yajlenko, 1990, 21.
407 S. Mrozek, 1989, 18.
408 P. Gauthier, 1988, 26.

gave rights of citizenship to those migrant craftsmen who had been sent into exile from their homelands and to persons who had moved to Attica as permanent residents and had brought their estates with them: "He permitted only those to be made citizens who were permanently exiled from their own country, or who removed to Athens with their entire families to ply a trade. This he did, as we are told, not so much to drive away other foreigners, as to invite these particular ones to Athens with the full assurance of becoming citizens; he also thought that reliance could be placed both on those who had been forced to abandon their own country, and on those who left it with a fixed purpose" (transl. by B. Perrin) (Plut. Sol. 24.4)[409]. Another law of Solon promoted the growth of crafts among Athenian citizens: "he turned the attention of the citizens to the arts of manufacture, and enacted a law that no son who had not been taught a trade should be compelled to support his father" (transl. by B. Perrin) (Plut. Sol. 22.1)[410]. For the first time a *demiurge* was elected to the *archonate* in Athens, although after the departure of Solon from Athens in 580/79 B.C., as is mentioned by Aristotle (Ath. Pol. 13.2.)[411]. However, the development of elements of industry and trade in the economies of the early city-states did not lead to the appearance of a political organization able to conduct profitable economic policies[412].

Nevertheless, the notion that craftsmen in Archaic Greece had a low social status does not seem correct. Analyses of narrative sources, the signatures of craftsmen, and vase paintings prove that no craft was considered to be of low social status or deprecated by society. The term "*demiurge*" was a honourable one, because skilled craftsmen were working for the whole of society. Under Solon the notion "*demiurge*" embraced representatives of very different professions: artists, doctors, singers and others were accorded equal status. The idea existed that there was a close connection between a craftsman's talent and the quality of his work. Masters' signatures, which first appeared in cases from the late 8th-early 7th century B.C., became common among sculptors after the late 7th-early 6th century B.C. They prove that craftsmen con-

[409] E. Ruschenbusch, 1966, 98, F 75; B.S. Ridgway, 1977, 286, note 5; P. Oliva, 1988, 68.

[410] E. Ruschenbusch, 1966, 90-91, F 56; P. Oliva, 1988, 66-67; H. Philipp, 1990, 99; V.P. Yajlenko, 1990, 22.

[411] L. Neesen, 1989, 63, Anm. 77.

[412] Ch.G. Starr, 1977, 94.

sidered their works to be achievements deserving of public attention, and testify to the growth of a self-awareness among craftsmen, an understanding of their unique individuality[413]. This emergence of a self-awareness was reflected in the casting of bronze figures of helmetmakers, dating to the late 8th-early 7th century B.C. (figures from the Belgrade and New York museums)[414], and in the images of craftsmen on late 6th century B.C. gems[415], as well as in a series of vases with paintings of scenes, related to metal treatment[416], which in any case reflected the position of metalworkers in contemporary society. Absolutely unique is a graffito with the name of a founder and his "self-portrait" on a casting mould from the Late Archaic layer at Olbia[417]. It is also maintained that Telesstas, whose name is inscribed on the rim of the bronze hydria of the first quarter of the 6th century B.C. found in Boeotia, may even be the craftsman because a bronze sculptor of the same name and his brother Ariston are known to have made an eighteen-foot high bronze statue of Zeus (Paus. V. 23.7).[418]. It is no accident that Greek art, even when it served religious ends, creating images of the gods, was much freer in its use of shapes and techniques than ancient Near Eastern art, and that early Greek tyranny was an important instrument in the destruction of traditional principles. The process of the decay of conservative traditions moved especially quickly in the colonies[419]. There are 10 known pictures of furnaces painted on vases dated from 570/560 to 470/60 B.C., most of them belonging to the first decades of the 5th century B.C. and one chous dating to 420-400 B.C.[420]. It is interesting that most of them belong to a rather short chronological period. The virtual disappearance of such scenes from vase paintings about the mid-5th century B.C. shows the growth of a negative attitude to craftsmanship as a form of physical labour[421].

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[413] R.J. Forbes, 1950, 99; H. Philipp, 1990, 83-89.

[414] C.C. Mattusch, 1975, 72, 90, note 125; J. Ziomecki, 1975, 102, 112, fig. 44; R. Thomas, 1992, 54-55, Abb. 39.

[415] C.C. Mattusch, 1975, 79; J. Ziomecki, 1975, 102, 115, fig. 45.

[416] C.C. Mattusch, 1975, 58-78; J. Ziomecki, 1975, 98-106; F. Brommer, 1978, 10 ff.; W.A. Oddy, J. Swaddling, 1985.

[417] V.I. Denisova, 1987, 327.

[418] E. Diehl, 1964, 5; C.M. Stibbe, 1992, 12.

[419] See: A.I. Zajtsev, 1985, 49-60.

[420] W.A. Oddy, J. Swaddling, 1985, 44-45. S. Morris, 1992, 360: "The emphasis on gods as craftsmen and manufacturers in Early Classical art and myth is but a specialized aspect of a new interest in artists in work".

[421] H. Philipp, 1990, 100, 110, Anm. 234.

The opinion has been expressed that ancient Greek society, at least from the Homeric till the Classical period, belonged to a category of competitive societies in which the aim of the individual to rise above his surroundings in fulfilling his own goals played an important role[422]. However, in spite of the "agonal" spirit adopted by Greek society, the question of economic competition including that between individual workshops and craftsmen seems to be much more complex. Some scholars have assumed that economic rivalry in its various forms was already well known in the Archaic period; others have held that such competition may have been an aim in itself, whereas the agonal spirit inspired forms of activity, which had no useful purpose, as well as forms, in which such goals were not primary[423]. If one analyses this non-economic aspect of ancient Greek metalworking, one comes to the conclusion that society supported creative experiments by craftsmen and the constant search for new artistic styles. The stimulus received by Greek metalworking from the East in the 9th-8th centuries B.C. was not just a simple matter of the adoption of forms, materials and technology, in the development of which the Greeks later made a valuable contribution[424]. A spirit of competition and self-perfection flourished in the Greek workshops[425]. As an example I shall mention that Greek craftsmen in the colonies creatively re-worked shapes and subjects adopted from Eastern art, for instance Lydian art. This in its turn had absorbed elements from various styles which had existed in the 7th-6th centuries B.C. in Asia Minor and the Near East. The Greeks then established the manufacture of metal ornaments and arms for the Scythians, thus finishing an original cycle in the transformation of an artistic style[426]. There is a noticeable undercurrent which was created by Greek craftsmen, in transforming and completing shapes adopted from the Near East. According to a hypothesis put forward recently, Greek craftsmen decorated large bronze cauldrons of Northern Syrian manufacture with griffin protomes[427], doing this in order to secure the protection of the deity for the most valuable offerings[428].

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[422] A.I. Zajtsev, 1985, 81.
[423] See: A.I. Zajtsev, 1985, 82 ff., note 25.
[424] G. Glotz, 1926, 127-128.
[425] Ch.G. Starr, 1977, 77, 83-84.
[426] M.Yu. Treister, in print.
[427] See: P.C. Bol, 1985, 73-74.
[428] N. Smith, 1986. See in general O.W. Muscarella, 1992, esp. 35-36; E. Akurgal, 1992.

As S. Morris has recently maintained, the period between the 11th and 6th centuries B.C. was marked in the Aegean by a full circle of Phoenician-generated industry and commerce. "The kinship and vitality of these regional centres belie the modern concept of a "Dark Age", as if major cultural activity in Greece was dormant between Homeric times and Classical Athens. In reality, these five centuries may have been dominated by Levantine enterprise in which the Greeks were willing apprentices and partners, in marriage as well as commerce. During these centuries, they absorbed innovations in religion, poetry, and politics that manifest themselves in the transformations known as Archaic art and culture"[429].

The role of slave labour in Archaic Greek craft industry was probably not significant. This is proved by the fact that in early documents about silver mining at Laurion there are no references to the use of slave labour. Besides, the use of slave labour in workshops would have meant that there was a stable demand for the output of the most developed Greek craft centres and that the owners of workshops had enough money to invest in purchasing slaves[430].

### *2.3.1. Prices of Metals*

We do not have enough data to allow discussion about the prices and relative values of metals in the Geometric and Archaic periods.

According to ancient literary sources, king Pheidon of Argos, who is thought to have reigned in the 8th or 7th century B.C., established a system of standard weights and measures in the Peloponnese, introducing Greek silver coinage on the Aeginetan standard and dedicating iron spits to the Argive Heraion as examples of a now outdated currency (Hdt. VI.127; Arist.Pol. 1310b16-27; Ath.Pol. 10)[431]. If we work from calculations of the weights of iron rods *obeloi* found at the necropolis of Argos, dated to ca. 730 B.C., and contemporaneous objects from the Heraion, an approximate correlation can be given of the values of silver and iron in Greece in the period in which coinage was adopted. It was about 1:2000[432]. The

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[429] S. Morris, 1992, 148.
[430] Ch.G. Starr, 1977, 91.
[431] N.G.L. Hammond, 1982, 338-339; P. Barceló, 1993, 112-115.
[432] P. Courbin, 1959; H.A. Cahn, 1960a.

hypothesis of P. Courbin that Argive obeloi represented a true proto-monetary system, was later to be criticized (for example, I. Strøm has recently maintained that iron *obeloi* were used in Greek sanctuaries for roasting meat for banquets[433]). However in spite of the fact that *obeloi* may have had many functions, that of proto-money was the most important[434]. R.J. Forbes stated that in the mid-6th century B.C. the Babylonian king Nabonides received iron from the mountains of Aman and Lebanon. Texts referring to the Neo-Babylonian period (625-538 B.C.) mention various quantities of iron, which had correspondingly different prices. So, one weight of silver was 240 times more valuable than the same quantity of iron from Yaman, and the equivalent of from 361 to 406 weights of iron from Labnan. In another text of Nabonides' reign silver was given a value of 225 times that of iron, while in a third text it was at least 624 times higher in value[435].

### *2.3.2. The Transportation of Metals*

Discussing the Archaic transportation of metal, A.M. Snodgrass singles out three stages in this: from the place where the ore was mined to the site where it was smelted; the transportation of metal ingots to the metalworking shop; the delivery of finished objects from the workshop to the customer. The last stage could have included an additional transfer from the craftsmen to the merchant. Snodgrass considers that the second stage did not in reality exist in the Archaic period; this is shown by the co-existence of foundries and smithies at Pithekoussai and Motya. In both cases the ore was transported to a site where it was smelted and finished objects were made there for local customers. If such a procedure was widely used, then an expensive transfer stage was to all intents and purposes eliminated and metal transportation was minimal, involving the episodic transference of ore and the trade in finished objects[436]. Although it is debatable whether one can definitely identify the sources of ore which are based on an ultimately unproven suggestion concerning the origin of the mineral ore found at Pithekoussai, A.M. Snodgrass' hypothesis attracts attention. Indeed it questions whether metal was transported as ore or as metal in-

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433 I. Strøm 1992, 49f.
434 P. Courbin, 1983; A.Yu. Sogomonov, 1988, 239-240.
435 R.J. Forbes, 1964, 251.
436 A.M. Snodgrass, 1980, 139-140.

gots. The transportation of metal ingots was wide-spread in the Bronze Age; this is proved by finds of copper and tin ingots in shipwrecks and elsewhere. Moreover, up to the 1st century B.C. when the Romans began the large-scale transportation of ingots—primarily of lead ingots from Iberian mines—this way of transporting metal was not common, to judge at least by the rarity of finds. The number of ingots from Classical and Hellenistic shipwrecks has grown a little in comparison to those of the previous period; at the same time there was some transportation of metal waste. However, the volume of ingots and metal waste carried by ships was not particularly large in comparison to that of both the Bronze Age and the Roman Imperial period. Thus, the data of underwater archaeology seems to support A.M. Snodgrass' hypothesis that transportation of ore was the main way of supplying the raw material for metalworking, although there is practically no documentary evidence for ore transportation[437]. Besides the find of ore mineral in Ischia, I should also mention in this connection some rectangular bars of magnetite quartzite from the Yagorlyk settlement. An interpretation of these in the same vein by A.S. Ostroverkhov was criticized (see above on p. 32) as was an observation of G.D. Papadimitriou that examination of 9th-7th century B.C. bronzes and slag suggests that tin in the form of cassiterite was used in copper refining[438].

In any event I am not aware of underwater finds of ingots, dating from the Geometric period[439]. Therefore, the only evidence from Greece is provided by small ingots of gold and electrum from a jeweller's hoard, dated to the last decades of the 8th century B.C. and found in Eretria[440]. Better known are gold and silver ingots of the 8th century B.C., so-called *Hacksilber*, found in Syria, which were probably both the hoards of toreuts and protocoins[441]. Such a distribution of hoards of precious metal ingots clearly points to those who had control of the trade in gold, silver and electrum in the Eastern Mediterranean. Characteristic of this is a hoard containing a considerable number of silver ingots of various types, including pieces with Aramaic inscriptions of king Barrekub, vassal of Tiglatpalassar, dated to ca. 730 B.C. and found

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437 M.Yu. Treister, 1992, 29.
438 G.D. Papadimitriou, 1989.
439 The find of an iron ingot at Kommos is dated to the 7th century B.C. (J.W. Shaw, 1984, 283, pl. 60b; S. Morris, 1992, 155, note 24).
440 P.G. Themelis, 1983.
441 M.S. Balmuth, 1975, 296-297.

at the palace at nc Zinčirli[442]. If one compares these observations about the distribution of hoards containing ingots of precious metals with the hypothesis, which I shall discuss below, about the work of Northern Syrian bronze founders in Greece, who influenced, for instance, the adoption of high-tin bronze technology in Corinth in ca. 760-750 B.C., and tin transportation from the Western Mediterranean on Phoenician ships, one obtains a convincing picture of Syro-Phoenician domination both in the distribution of crude metal and metalworking technology in the Eastern Mediterranean. However, it this domintion was never a monopoly, and the Greeks themselves had episodically undertaken voyages, like those to Temessus described in the Odyssey. Besides this, there is abundant evidence that the Phoenicians were carrying Greek pottery by the 8th century B.C. at the latest[443].

An important underwater find of lead and copper ingots comes from a shipwreck near the Giglio reef in the bay of Campese; it was accompanied by amphoras of East Greek, Phoenician and Etruscan manufacture, Corinthian, Ionian, and Laconian plain and painted pottery, bucchero, lamps, weights, and arrowheads, which date the shipwreck to ca. 600 B.C.[444]. M. Bound considers the finds to be the cargo of an Etruscan ship. This view is supported by some other scholars[445]. However, after the find of the remains of an 11 m long ship M. Bound has come to the conclusion that the ship was not Etruscan, but Greek. Furthermore, general historical observations prove that the main role in the Greco-Etruscan trade was played by Greek merchants, most probably by Ionians[446]. Besides, the geographical spread of the origins of the goods is astonishing. G. Shipley has better reason to suppose that the ship's cargo shows that the vessel had made a lengthy cabotage voyage from the Eastern Mediterranean and the Aegean Islands, and that even if the ship was not Samian, it certainly had visited that island. The considerable number of Etruscan amphoras can be probably explained by the fact that just before the wreck, the ship had visited an Etruscan harbour. The composition of the cargo, at any rate, re-

[442] F. von Luschan, 1943, 119-121; M.S. Balmuth, 1975, 296-297. 12 smaller ingots have a total weight of 335.13 gr; another pieces, including those with inscriptions weigh 450.25; 497.38 and 255.48 gr.

[443] A.J. Graham, 1990, 50; M.Yu. Treister, 1992, 30.

[444] M. Bound, 1985; T.C.B. Rasmussen, 1986, 114; A.J. Parker, 1992, N 451 with references (ca. 600-590 B.C.).

[445] See, e.g. P. Rendini, 1988, 191-198.

[446] P. Kracht, 1991, 69-72.

flects the complicated character of trade relations which had already been established by the 7th century B.C.[447]. A few more words concerning the wreck from Giglio. Recently the first and second season reports were published of the investigation of the wreck at Giglio[448]. M. Bound states that the ceramics on board come from five or six distinct geographic locations around the Mediterranean, but considers it improbable, although not impossible, that the ship had picked up all these pots herself at their individual ports of origin. Bound considers it to be more likely that "she was working through a fairly sophisticated system of brokerages, or relay points, where off-loading of goods could take place for reshipment to new destinations"[449]. M. Bound states that "because only four ingots have so far been found, it is too early to speculate for certain about the nature of their role as part of the ship's cargo, and where they might have been smelted", however, mentions that "from literary sources we know that it was the mineral wealth of the Etruscans that was at the heart of Greek and Phoenician trade with Etruria"[450]. One more lead ingot was excavated in 1983. All the lead ingots, while they were in a semi-molten state, were inscribed with the letter "V". Besides this, the latest find is also inscribed with the letters *upsilon* and *alpha*. The rough, plano-convex profile of the lead ingots and their shape, as M. Bound has stated, have parallels among the lead ingots from the Porticello and Kyrenia wrecks. M. Bound suggests that both the lead and copper ingots from the wreck could have easily been smelted on the island using the most of primitive methods[451]. The diversity of the cargo of the ship, which sank near the coast of Italy, is rather similar to that of Late Bronze Age shipwrecks which contain metal ingots; it is thought that these vessels had also completed long cabotage sailings, and it is even supposed that craftsmen may have been on board these ships, completing orders during stays in harbours[452].

We can note in this connection a find at Rochelongue, to the west of cap d'Agde, France. A large bronze hoard dated to the mid-6th century B.C. was found with objects looking as if they had originally been packed in bags. There were at least 800 kg of copper ingots (the heaviest weighing over 11 kg); the 1700 bronze ob-

[447] G. Shipley, 1987, 61-62; D.W.J. Gill, 1988, 178.
[448] M. Bound, 1991; 1991a.
[449] M. Bound, 1991, 181.
[450] M. Bound, 1991, 181, 190-192.
[451] M. Bound, 1991a, 226-227, fig. 64.
[452] J. Velissaropoulos, 1980, 58, note 14; M.Yu. Treister, 1992, 30.

jects (some new, some unused but with manufacturing faults, others broken), consisted mostly of axes, harness fittings and decorative items, with a small number of weapons. Parallels can be found in north-eastern Spain, western France and north-western Italy. A.J. Parker states that although no traces of a ship were found, the hoard can only be explained as the wreck of a small vessel which was carrying an itinerant coppersmith[453]. While the vessel, which sank in the bay of Campese, was sailing in the Eastern Mediterranean, the ship that went down near Agde, was probably making a similar cabotage voyage in the Western Mediterranean.

A variety of ingots has been found in a wreck near the mines of Montevecchio and Ingustosu on the west coast of Sardinia, at Domu de S'Orku, near Arbus. There were several ingots, said to be mill-shaped, of lead alloy (Pb 64,5%, Sn 12,4%, Al 2,04%)—measuring only about 25 x 17 cm. Others were of rectangular or loaf shape, and there were also some blocks of a copper-tin-lead alloy, as well as lead plaques, some of which bore a geometric decoration. The date, ca. 700-400 B.C. (?), was supplied by the handle of an Iron Age Nuragic jar[454].

The significance of find from the coast of Sardinia is great. In spite of the broad dating, the following points are important. Trade in metal ingots from the mining areas of Sardinia included at this early date ingots of lead and copper-tin-lead alloys. Thus, these metal alloys were not produced at metalworking shops, but in metallurgical workshops, which exported not metal ore, or even raw metals as ingots, but alloys already prepared according to a certain recipe. This fact presupposes at least stable relations between the metalprocessing areas of Sardinia and some overseas customer, who had probably ordered an alloy of a given specification. I am not aware of similar finds of ths period, however, perhaps, the closest parallel, although chronologically quite distant, is the find of six Roman pewter ingots in the river Thames near Battersea[455].

The wrecks discussed above are important because they represent finds of metal ingots, which are extremely rare in the Archaic period. Thus, the idea that the main form in which raw metal was transported at that time was as ore can be ignored. These wrecks stress the diversity of forms in which metal was transported. There is also a hypothesis that metal ingots as well as cargoes of metal

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[453] A.J. Parker, 1992, N 993; L. Long et al., 1992, 229.
[454] A.J. Parker, 1992, N 365.
[455] M.J. Hughes, 1980.

objects may have been used by ancient sailors as ballast to compensate for the lack of any other cargo in a ship and that therefore these items may have sometimes travelled for long periods[456]. The above-mentioned hypothesis about the presence of craftsmen on board ships carrying cargoes of ingots and the model of trade in metal, which can be conventionally described as the "sailing workshop", seem be true not only for the Archaic period but for later on as well (cf. below on p. 358 the interpretation of the Hellenistic shipwreck near Megadim in Israel). This type of trade in metals perhaps co-existed with the long-distance sea trade discussed by A.M. Snodgrass, and with overland or rivertrade over short distances. A probable explanation for the rarity of underwater finds of Archaic ingots is that the prevailing practice of long-distance trade in metal in the case of the monopoly mining of a given metal, like that of copper in Bronze Age Cyprus, or lead in Iberia in the first centuries A.D., changed in the Archaic period to focus on overland transportation over short distances. For example, the metalworking centres of the Peloponnese, which flourished at that time, may have received copper from the mines of Euboea and Laurion both as ore and as ingots. This certainly happened only with metals which were mined in Greece. The existence of an Archaic trade in metal ingots in Greece is proved by finds of similar round copper ingots with stamps in the Samian Heraion and at Olympia[457]. The Spartans, who went to Sardis to acquire gold to make a statue of Apollo, which was presented to them by Croesus (Hdt. I. 69), undoubtedly had to carry it by sea, as had been done by Colaeus with Iberian silver a century before. The same means of transport to Sicyon or directly to Olympia was probably used for the "Tartessian bronze" needed to cast two bronze *thalamoi*, dedicated by the tyrant and *demos* of Sicyon. However, sea transportation was more typical for precious metals, the need for which was hardly very great before the invention of coinage. Besides, the fact that such voyages attracted the attention of Herodotus proves their extraordinary character.

Moreover, even the voyages of Colaeus may be interpreted in different ways. For instance G. Shipley considers that it may had been a long cabotage voyage like those of the ship which sank near Giglio[458].

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456 S. McGrail, 1989, 356-357.

457 W.-D. Heilmeyer, 1981, 442-443, Abb. 2-3; G. Zimmer, 1990, 161; M.Yu. Treister, 1992, 30-31.

458 G. Shipley, 1987, 62.

For a long time it has been suggested that Sostratos of Aegina, like Colaeus, had also been involved in the trade in silver with Southern Iberia, however, this does not accord with the absence of traces of Iberian silver in the early coinage of Aegina[459].

It is hard to give a precise estimate of the volume of metal transported. For example, I. Hahn, who assigns a relatively important role to trade in Archaic Greece, especially to sea trade, stresses that it was primarily a trade in metals, mainly in iron, and to a lesser extent in non-ferrous metals[460]. However, the find from Rochelongue suggests that copper ingots were also already in the mid-6th century B.C. being transported in substantial quantities, comparable to those of later cargoes, and that they may have constituted a considerable part of cargoes (compare the 800 kg of copper ingots from Rochelongue with the estimated weights of Late Archaic wrecks with amphora cargoes from 600 kg to 5 tons)[461].

### *2.3.3. The Distribution of Metal Objects*

#### *2.3.3.1. Votive Offerings at Sanctuaries*

What types of distribution were most typical in the period discussed? I think that the prevalent form was of votive offerings at sanctuaries. It has already been stated that the most typical finds have been of metal objects made during excavations of sanctuaries; finds of such pieces in settlements and graves are considerably less common. It has also been already contended that the enormous increase in votive offerings in the 8th century B.C. cannot wholly be explained by the a rise in population. Take for example the distribution of Geometric metal objects: before 800 B.C. they come almost entirely from burials, but in the Late Geometric times the vast majority have been dedicated at sanctuaries. It seems no exaggeration to state in J.N. Coldstream's words that: "The subsequent history of Greek bronzework is closely connected with the expanding prestige of the great sanctuaries, and the intense rivalry which they inspired was always a powerful stimulant to the vitality of Greek art"[462]. This is demonstrated for instance by the distribution of bronze statuettes, which were the common type of

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459 T.J. Figueira, 1981, 249.
460 I. Hahn, 1983, 32-33.
461 L. Long et al., 1992, 230-231.
462 J.N. Coldstream, 1977, 338-339.

privately dedicated object in Greek sanctuaries, which sometimes bear votive inscriptions[463]. However, there are conflicting points of view. For example, J.B. Salmon supposes that the export Corinthian bronzes of the 8th-7th centuries B.C. was very limited, and that most articles appear outside Corinth as a result of sporadic exchanges, except for finds at the Pan-Hellenic sanctuaries at Olympia, Delphi and Dodona, which form, in his opinion, an insignificant proportion of the total output of Corinthian metalworking shops[464]. The growth in the output and sales of Corinthian goods was probably influenced by the construction of a canal over the Isthmos, a *diolkos*, used not to transport trading vessels but cargoes, primarily of wood and marble, but judging by the inscriptions on buildings, tiles and metals as well[465]. In contrast to J.B. Salmon, P.C. Bol considers that although the export of bronze vessels from Greece never reached the scale of that of painted pottery, a considerable part of the output of Greek metalworking shops of the 7th-6th centuries B.C. was intended for sale to barbarians, which led to rivalry in the Mediterranean markets of those metalworkshops which produced goods for the export trade[466].

A selective estimate of the distribution of finds of a mass category of bronze items such as pins, which is based on data published by I. Kilian-Dirlmeier[467], gives the following results. In Perachora 127 pins were found, dating from the Geometric and Archaic periods, including 28 at the sanctuary of Hera Akraia (Geometric); 97 (19 : Geometric, 78 : Archaic) at the sanctuary of Hera Limenia and only 2 in the settlement (1 Geometric, 1 Archaic). Thus, for each of the periods finds from the settlement constitute 1.5-2% of the total. 54 pins come from the Acropolis of Sparta (24 : Geometric, 30 : Archaic), whereas 1408 items are from the sanctuary of Artemis Orthia (1016 : Geometric, 392 : Archaic) and 61 come from Menelaion (20 : Geometric, 41 : Archaic). 1348 pins (954 : Geometric, 394 : Archaic) were found at the Argive Heraion, while only 131 finds come from the excavations of Argos (114 : Geometric, 17 : Archaic).

Another example is given by the distribution of imported bronze, silver and iron finds in Archaic (ca. 625-575 B.C.) graves, houses and sanctuaries at Vroulia. In the 26 graves analyzed there were

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463 R. Thomas, 1992, 21 ff.
464 J.B. Salmon, 1984, 118-119.
465 J.B. Salmon, 1984, 133-139; C.M. Reed, 1984, 38-39; B.R. Macdonald, 1986.
466 P.C. Bol, 1985, 80.
467 I. Kilian-Dirlmeier, 1984.

found 22 bronze, 1 silver and 2 iron objects, while only 1 bronze object originates from the excavations of 11 houses: the two sanctuaries yielded 2 bronze, 1 silver and 4 iron objects[468]. As is shown, the proportion of finds from sanctuaries to objects found outside them varies for different sites; there is also a tendency for these proportions to increase or decrease in the Archaic period in comparison to the previous period; however on the whole, the number of finds from the sanctuaries is considerably higher. I have to mention that some categories of metal votives had no practical purpose; these were the so-called models of objects, miniature imitations of arms or ornaments, including reproductions of armour in precious metals[469]. Such articles were most probably manufactured directly in workshops located at the sanctuaries and may have been used only as votive offerings. Local features may have somehow depended on regulation of votive choice. The astonishing quantity of votives made of precious metals found in Ephesus allow us to assume that such offerings were encouraged, if not required, by the temple administration. It was probably prescribed that on certain occasions the votives dedicated at the sanctuary should be made of gold or electrum[470]. From that point of view we can consider the hypothesis of B. Berkvist that in the 8th century B.C. workshops may have existed at the temples, established specially for the production of votives[471]. However, not all such materials may be described as votives, because a certain part of the arms manufactured in workshops at the sanctuaries was for military purposes[472]. According to R. Hägg, who noticed the presence among finds from Philia and Kalapodi of details of doors, all materials from the sanctuaries were objects in daily use, but craftsmen may have dedicated to the temple the first specimens of their products[473].

Examples of the offering of a votives manufactured in the workshop of another Greek city-state are finds of Peloponnesian bronze figures, for example, the famous lion statuette with a dedication by Eumnastes the Spartiat to Hera, engraved in a Laconian script of the mid-6th century B.C. a statuette of Artemis Daidale found near Olympia also with a Laconian inscription, dated to ca. 550-530

[468] I. Morris, 1992, 189, table 12.
[469] C.G. Simon, 1986, 202, 256.
[470] C.G. Simon, 1986, 417-418.
[471] *The Greek Renaissance*, 1983, 147.
[472] A.Yu. Sogomonov, 1988, 239.
[473] *The Greek Renaissance*, 1983, 147.

B.C.[474], or the pendants made workshops on mainland Greece and dedicated at the Heraion of Samos[475]. Starting with works of the mid-8th century B.C., Corinthian bronzes have constituted a significant proportion of finds in Delphi[476]. The dedication of two big kraters of "Daedalan workmanship" by Phalares, the tyrant of Acragas in 571-555 B.C., is described in the inventories of the temple of Athena Lindia in Rhodes. In the first half of the 6th century B.C.Kleobules dedicated at the same temple eight shields and a gold diadem before the cult statue of Athena[477].

To gauge the volume of metals needed for such dedicatory item, I would mention the dedication at Olympia by Myron, the tyrant of Sicyon, and the *demos* of Sicyon of two bronze *thalamoi* which were decorated entirely or partly with bronze. Pausanius (VI.19.1-4), who had seen these at Olympia, mentioned that he did not know whether they had been made of Tartessian bronze, as the Eleans had said; the ancient geographer had mentioned a weight—500 talents. It is not clear whether Pausanius was referring to the weight of the small *thalamoi*, or to that of both of them; at any rate the weight of this votive object is estimated from 13 to 25 tons[478].

It is noteworthy that in this way not only did articles made in one Greek city travel to another, but also items manufactured in non-Greek workshops, primarily small bronze ornaments, which found their way into Greek sanctuaries as a result of pilgrimages by non-Greeks. This is proved, for instance, by finds of bronze pendants, manufactured in Macedonia, at Pan-Hellenic sanctuaries, for example at Olympia, Perachora, Aegina and Samos[479]. Among finds from the Samian Heraion we can single out a considerable number of items, originating from Phrygia, Cyprus, North Syria, Urartu, and Egypt, chiefly from the 7th-6th centuries B.C.[480]. So-called "Phrygian fibulas" have been found in considerable quantities at Ionian sanctuaries and at the temples of mainland Greece[481]. A.Bammer, discussing finds of votives of the 8th-7th centuries B.C.at the Ephesian Artemision, states that some were dedicated by the Cimmerians, not only by men, but by women[482]. Xenophobia was

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474 G. Dunst, 1972, 140-144, Taf. 56; R. Thomas, 1992, 23-24, Abb. 10.
475 I. Kilian-Dirlmeier, 1979, 220, Taf. 105 B; G. Shipley, 1987, 42.
476 J.B. Salmon, 1984, 84-85.
477 W.K. Pritchett, 1979, 244.
478 A. Griffin, 1982, 31, 101-106; P.C. Bol, 1985, 93-94.
479 I. Kilian-Dirlmeier, 1979, 225, Taf.103B; 236, Taf. 106A.
480 G. Shipley, 1987, 42-43.
481 C.G. Simon, 1986, 198.
482 A. Bammer, 1990a, 34-35.

alien to Greece in the 7th-6th centuries B.C.: the visiting of sanctuaries and offering of votives was not prohibited to foreigners[483]. This notion prompts us to consider one of the possible ways in which non-Greek shapes were adopted by Greek craftsmen (there are known contemporaneous pendant types produced in Macedonia, Albania, Thessaly, and the Peloponnese)[484], because workshops existed at all the known sanctuaries of that period. Some of the votives may have been dedicated by Greeks, e.g. Ionians, who in ca. 660 B.C. were in the service of the Egyptian Pharaoh Psammetichos I. It is noteworthy that most of the bronze statuettes of Egyptian origin reached the Samian Heraion from the mid-7th to mid-6th century B.C.[485].

Among the votives found at the Samian Heraion we know of bronzes of 7th century B.C. Etruscan manufacture, in particular those produced at Vetulonia. H. Kyrieleis mentions that a significant number of the 8th-7th century B.C. bucchero and bronzes found in Greek temples demonstrate the intensity of relations with Etruria and Central Italy. In this context the most important location was Olympia where a large quantity of arms and fibulas of the 8th-7th centuries B.C. have been found. Whereas finds of arms and armour are considered to be votive offerings made by Greeks and typical of Olympia, other significant metal votives found there, such as a silver plaque and utensils, may have been dedicated by Etruscans[486].

I. Kilian-Dirlmeier has published a specialist study of "imported" votives found at Greek sanctuaries of the 8th-early 7th centuries B.C., and discusses the materials from four sanctuaries located in various parts of the Greek world: Pherae in Thessaly, Perachora in the coast of Central Greece, as well as at Olympia and the Samian Heraion[487].

Only 2% of approximately 3750 finds from the sanctuary of Artemis Enodia in Pherae, the main sanctuary of a rural area, is represented by imported pieces, primarily by pieces manufactured in the Balkans (26%), Macedonia (22%) or the Aegean Islands (24.5%). Less popular were articles from Peloponnesian (10.4%) and East Greek (2.6%) workshops, whereas non-Greek items formed only 14.2% of imported votives, these being represented by

[483] I. Kilian-Dirlmeier, 1979, 263, Anm. 28.
[484] I. Kilian-Dirlmeier, 1979, 263-264.
[485] G. Shipley, 1987, 56.
[486] H. Kyrieleis, 1986.
[487] I. Kilian-Dirlmeier, 1985, 215-254.

articles of Italic, Egyptian, Phrygian and Phoenician manufacture[488]. Votives of Thessalian origin, mainly fibulas, pins, pendants as well as bronze figurines, occur fairly often in Central Greek and Peloponnesian sanctuaries. While the statuettes may have been cast on the spot by Thessalian craftsmen or may have been sold by Thessalian merchants, the details of clothing and the ornaments may have been dedications by Thessalian pilgrims. The temple of Artemis Enodia was probably of lesser importance for inhabitants of mainland Greece to the south of Thessaly. On the other hand, the high proportion of articles made in workshops of the Aegean Islands, exclusively fibulas, which do not correspond to the geographical location of the sanctuary, means perhaps that it was visited by pilgrims from the Islands, mostly females. A rather large proportion of Macedonian production, chiefly pendants and bronze beads of various shapes, which were also made in Thessaly according to Kilian-Dirlmeier, was brought by the travelling Thessalians as curiosities. Non-Greek votives are represented to a considerable extent by articles of Balkan manufacture (Thrace, Glasinač and the interior of the Balkans), primarily personal items, such as fibulas, buckles, pendants, and bracelets. It is difficult to state whether they were brought to the sanctuary by Greeks (Thessalians) or dedicated by migrant Balkan shepherds[489].

The majority of the 438 imported votives found at the sanctuaries of Hera Akraia and Hera Limenia at Perachora is formed by items of Phoenician manufacture (74%); finds of Argive origin (11.9%) and East Greek objects (6%) are represented by a smaller number of objects, while those made in Egypt, Italy, in the Balkans, Macedonia, Thessaly, and the Aegean Islands are extremely rare. Articles of Argive manufacture predominate among imported Greek (non-Corinthian) items. This is perhaps due to the fact that the Argive Heraion participated in the foundation of the Hera Akraia sanctuary. Among non-Greek articles, items of Italian, Balkan and Western Iranian origin, represented by details of clothing, perhaps point to foreign pilgrimages, whereas an Egyptian object (a mirror) should be put down to trade with Corinth. However, this picture of imported offerings should be relativised due to the considerable number of faience objects among the pieces of Phoenician manufacture[490].

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488 I. Kilian-Dirlmeier, 1985, 216-217, Abb. 1.
489 I. Kilian-Dirlmeier, 1985, 220-223, Abb. 3-4.
490 I. Kilian-Dirlmeier, 1985, 225-230.

A larger proportion of objects than in Pherae and Perachora was manufactured in the workshops of the Greek towns (ca. 77%) and this is attested by 793 votives from Olympia. They are represented by pieces from various centres of production; this is possibly explained by the Pan-Hellenic character of the sanctuary. Argive (32.8%) and Attic (17.3%) products predominate. The variety in the distribution of articles made in Greek centres was not directly linked to the number of visitors. It should be rather explained by the specific characteristics of the production centres, of which Attica and the Argolid were the most important in the period discussed, and the local cult practice of dedicating tripods, cauldrons and armour. Articles of Italian workmanship (8.9%) were the most numerous among non-Greek votives. However this fact does not prove the greater importance of the sanctuary's western relations, because the total number of Eastern objects, including those of Phoenician, Assyrian, Syrian, Phrygian, and Cypriot origin is nevertheless higher (12.8%). It is noteworthy that Italian votives are chiefly represented by details of clothes and arms, while bronze ware was brought from the East, and fibulas also came exclusively from Phrygia. This fact gives grounds to suppose some Greek activity in Italy: objects in personal use testify to personal contacts, finds of arms to war booty and to dedications by warriors. On the other hand, Eastern bronze vessels prove the penetration of luxury items as objects of trade or as gifts. The modest number of votives of Balkan manufacture (details of clothes, and a pendant) perhaps indicates Balkan pilgrimages. The wide range of objects manufactured both in Greek and non-Greek centres and found in Olympia shows that already in the early period the sanctuary had not only a Pan-Hellenic, but also an international, importance[491].

A contrasting picture of the distribution of imported votives to that seen at Olympia is characteristic of the Samian Heraion. Only about 15% of 404 votives is represented by articles of Greek workmanship. Products from mainland Greece are found with ceramics alongside bronze statuettes from Corinth and Laconia. North and South Greek votives were found in practically the same proportions (4.4% and 5.5% respectively), whereas items from Thessalian and Macedonian workshops are primarily pieces related to clothing and ornaments, being the modest personal dedications of visitors from North Greece[492]. The majority of non-Greek votives is formed by

[491] I. Kilian-Dirlmeier, 1985, 230-235.

[492] I. Kilian-Dirlmeier, 1985, 236 ff. Cf. the view of C. Dunant and C. Rolley that

products of Eastern workshops: of Cyprus (16.3%), Egypt (12.6%), Phoenicia (9.5%) etc.; on the other hand, Italic imports are insignificant, comprising only 1.7%. It is noteworthy that the Eastern objects there include practically no details of clothing. On the contrary, dedications such as bronze vessels, utensils, arms, details of horse harness, statuettes predominate[493]. They were probably brought directly from their places of manufacture or in the course of trading contacts. The imported votives from the Samian Heraion prove that this was visited by pilgrims from all over the world, from Spain to Iran and from the Caucasus to Egypt[494].

From the 6th century B.C. bronze statues were installed in the sanctuaries as votives[495].

The recent study by M. Donderer seems to prove that the Greeks practised the so-called "*irreversible Deponierung*" of large sculptures. The practice of hiding of sculptures is basically explicable by religious motives. Not only cult but also votive statues were deposited in Greek sanctuaries[496]. Judging by the materials compiled by Donderer, the practice of depositing stone sculptures existed from ca. 600 B.C.[497]. The earliest known bronze sculptures which may be considered to have been deposited are the statue of Zeus from Ugento (see above concerning its dating) and the so-called ephebe from Selinus[498], allow us thus to maintain that the depositing of bronze sculptures began in the Late Archaic period.

Analysis of finds of arms and armour from Archaic sanctuaries allows us to discuss the mechanisms for the distribution and redistribution of one of the most wide-spread categories of metal votive object.

Arms taken from enemies were usually dedicated to the gods. Those taken on the field of battle were even more honorific because victory and prowess in war were always admired. Of all panoply, shields and helmets were probably the most prized components[499]. So, judging by inscriptions on a helmet and a greave,

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the Macedonian bronzes may had been brought there by the intermediaries from Samos, while the Macedonian bronzes from Thasian Artemision prove armed conflicts of the first Greek settlers of Thasos with the inhabitants of neighbouring regions. See: C. Dunant, C. Rolley, 1987, 61.

493 See, e.g.: U. Jantzen, 1972; H. Kyrieleis, W. Röllig, 1988; D. Parayre, 1989; H. Kyrieleis, 1993, 146-148.

494 I. Kilian-Dirlmeier, 1985, 236-243; H. Kyrieleis, 1993, 148.

495 F. Eckstein, 1969.

496 M. Donderer, 1992, 207-208, 230-232.

497 M. Donderer, 1992, 234ff.

498 M. Donderer, 1992, 254, N 3-4.

499 A.H. Jackson, 1991, 229-230.

the Argives dedicated war prizes taken from the Corinthians in ca. 500 B.C. at Olympia. These votives were offered both at the Pan-Hellenic and at local sanctuaries. C.G. Simon considers that most of the Archaic arms and armour found at local sanctuaries represent trophies taken from enemies[500]. The existence of such practices is proved both by the stories of ancient writers and by dedications engraved on pieces found at the sanctuaries, primarily at Olympia: on helmets and greaves, shield overlays, spearheads and other details of equipment, dating from ca. the mid-6th century B.C. to 425 B.C., all listed by K.W. Pritchett and E. Kunze[501]. Athens, Orchomenoi, Argos, Rhegium, Messenia, Thebes and some other Greek city-states figure among dedicators from the Late Archaic period. Only the Spartans considered it worthless to dedicate to the gods armour which had belonged to "cowards" (Plut. Mor. 224B)[502]. Of new finds I shall mention a Corinthian helmet with a dedication by the Rhamnuntians in a local sanctuary of Nemesis of booty captured in the Lemnos campaign of 499 B.C. commanded by Miltiades[503]. Dedications of arms and armour captured in war were usually made during the Archaic era in the name of the *poleis*, and the earliest private dedications of such objects are dated to the early 5th century B.C.[504].

Thus most of the finds of arms and armour at Greek sanctuaries may be considered to have been redistributed as war booty[505]. A.H. Jackson maintains that an estimate that Olympia received about 100000 helmets over the 7th-6th centuries B.C. need not be thought to be seriously exaggerated[506]. Olympia could attract offerings from any battlefield in the Archaic Greek world and the losers in a hoplite battle might die in their hundreds or even more. Delphi would not have been far behind. Even Isthmia, celebrated only from the early 6th century, but centrally placed on land and sea routes, still has traces of 200 helmets and innumerable shields, most from the hundred years preceding the Persian invasion. Her annual intake might have been in the order of scores rather than that of Olympia's figures but could still have persuaded many to add to

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[500] C.G. Simon, 1986, 255.

[501] K.W. Pritchett, 1979, 290-291; E. Kunze, 1991, 125-130; cf. C. Rolley, 1993, 396 concerning inscription N 2-3 from Olympia (E.Kunze, 1991, 125-126).

[502] See, e.g. A.H. Jackson, 1991, 232, 242.

[503] H.W. Catling, 1986, 17, fig. 16.

[504] K.W. Pritchett, 1979, 269-271.

[505] A.H. Jackson, 1991, 230.

[506] A.M. Snodgrass, 1980, 131; cf. A.H. Jackson, 1991, 244.

her displays[507]. "Technological redistribution" was probably not yet wide-spread in the Archaic era, i.e. the votive was valued not only on the basis of its metal value, but from the point of view of its functional use as well. Pausanius (VI. 19. 13) did mention a shield hoisted instead of an acroterium to the top of the Megarian Treasury at Olympia, part of the booty captured in the war against Corinth in ca. 510 B.C. Other examples of analogous dedications, collected by K.W. Pritchett, relate to the later period[508].

A smaller number of votives consists of dedications of the arms and armour of the winners in celebration of a victory. Examples of such votives are the dedication of a shield in the sanctuary of Trophonios in Lebadeia by Aristomenos (Paus. IV. 16.7) and that by the Pharaoh Neho of the arms sent to Didyms (Hdt. II. 159). Many of the epigrams of the "Palatine anthology" testify to the practice of dedicating arms, when the owner did not need them any more, either because they were too old or for some other reason. However, this practice is thought to have been wide-spread in the Hellenistic period. In any case in the Archaic period, when every hoplite equipped himself with a panoply, which was usually as well decorated as he could afford[509], this custom was rather the exception than the rule[510]. Only very rare pieces of the 6th-early 5th century B.C., including a spearhead and three helmets from Olympia, are considered on the basis of the inscriptions to have been dedicated by private persons. To the same category of votives belongs a bronze plaque with a dedication of arms by a Laconian, perhaps because he was above the age limit for military service[511].

Finally, Archaic sanctuaries may have been used as an arsenals, from which arms and armour could be taken in time of need and then returned. This is probably indicated by analysis of some damaged helmets with votive inscriptions from Olympia. The same role was played in Athens by the Chalkotheke, the inventories of which were found on the Acropolis; the lists contain considerable numbers of weapons[512]. Although these inventories date from the Classical era, the suggestion that similar use was made of sanctuaries already in the Late Archaic period is supported by finds of arms and

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[507] A.H. Jackson, 1991, 244-245.
[508] K.W. Pritchett, 1979, 278-279. See also A.H. Jackson, 1991, 229 f.
[509] K.W. Pritchett, 1979, 248, 277.
[510] A.H. Jackson, 1991, 230.
[511] K.W. Pritchett, 1979, 253-254.
[512] W.K. Pritchett, 1979, 257-263.

armour, primarily those from Archaic times on the Acropolis[513]. In the striking image of P.C. Bol, the metal of Geometric tripods underwent significant metamorphoses before being finally converted into Turkish guns cast from the Classical masterpieces. However, at least before the 5th century B.C. some metal votives were considered to be the sacral property of a deity and were not liable to be melted down, although they were not exhibited to visitors, but rather found their way into a *bothroi* or a well[514].

As I have already mentioned above the volume of metal and value of objects dedicated at Greek sanctuaries by Eastern rulers, e.g. Croesus or Neho, was considerable: these form a separate group[515]. The dedication of two gold statues and ten bowls in the temple of Athena Lindia by the Egyptian Pharaoh Amasis as well as numerous offerings at the same sanctuary by one of Darius' satraps, Artafernes, belong to the same category[516]. As C.G. Simon has stated, these luxurious offerings were dedicated on special occasions and had the particular purpose of glorifying the dedicator. Such examples of self-advertisement are especially typical of the Ionian sanctuaries[517]. The percentage of such royal gifts among the votives found at Greek sanctuaries may be rather significant. O.W. Muscarella, discussing the dedication by Midas of his own throne to the god at Delphi, makes an attempt to explain the presence of oriental cauldrons in Greece as a result of diplomatic gift-giving[518]. However, H. Kyrieleis suggests that in the case of the votive inscription in Aramaic, probably identified as a present or tribute to the Syrian ruler Hazael of Basan, on a bronze relief horse nose-piece from the Samian Heraion, it is unlikely that Hazael sent this piece directly to Samos: in the course of time it may well have fallen into other hands, either been passed on as a gift or as a war trophy and thus by some roundabout way finally came to be dedicated as a valuable votive offering in the sanctuary of the goddess of Samos[519]. I. Strøm has shown that the pattern of distribution

513 C.G. Simon, 1986, 255-256.

514 P.C. Bol, 1985, 14.

515 See about dedications of Egyptian pharaohs in the Greek sanctuaries: M.M. Austin, 1970, 41-42; about Croesus dedications see, e.g. R. Krumeich, 1991, 53-55 with references.

516 W.K. Pritchett, 1979, 244.

517 C.G. Simon, 1986, 416.

518 O.W. Muscarella, 1992, 42-43.

519 H. Kyrieleis, W. Röllig, 1988; H. Kyrieleis, 1993, 146. Cf. the view of S. Morris, that such objects may have been dedicated as well as transported by foreigners (S. Morris, 1992, 147, note 108).

for Near Eastern shallow bronze bowls and bronze cauldrons is constant, restricted to sanctuaries and primarily to sanctuaries of the same small group of deities, Apollo, Hera, Artemis, and Athena. She assumes that an interpretation of the bronze vessels as votive gifts would not be well-founded. Their presence in the same group of sanctuaries spread over the whole of Greece indicates close contacts between sanctuaries of related deities, perhaps even a kind of coordination of acquisition[520]. However, among Eastern objects found in the Greek sanctuaries there are probably also pieces which had been brought back from voyages by sailors and merchants[521]. C. Morgan even maintains that many of the exotic luxuries dedicated at Ionian sanctuaries (such as the Phoenician, Egyptian and Cypriot items found at Samos) may also arrived in this way. Nevertheless it is impossible to understand fully the pattern of dedication and its wider meaning without considering local political circumstances. In her opinion, the example of a dedication of Colaeus at the Samian Heraion of a bronze griffin-head cauldron supported by double life-size kneeling figures (Hdt. IV.152), even given some exaggeration by Herodotus, proves that trade, or piracy, offered rich pickings[522].

Already in the 8th century B.C. the development of tripods and figurines revealed a growing social distinction in the dedications at Olympia, with different modes of production answering to different patterns of dedication by different social groups[523].

A modest part of votives in the sanctuaries represents the offerings of commoners, primitive clay and wooden figurines or silhouettes cut from bronze sheets like the finds at the Samian Heraion[524].

The works of Greek founders, for instance statues, are found outside Greece as war trophies, for example, the statues of the Tyrannicides by Antenor installed on the Agora in the late 6th century B.C. or after 490 B.C. were captured by Xerxes[525].

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520 I. Strøm, 1992a, 46-60, esp. 57, 60.
521 I.J. Winter, 1988, 210.
522 C. Morgan, 1993, 33.
523 C. Morgan, 1993, 24.
524 H. Kyrieleis, 1988.
525 See, e.g.: J. Boardman, 1985, 24; P. Gauthier, 1985, 92-93; C.C. Mattusch, 1988, 88, 119-120; S. Morris, 1992, 298 ff.

*2.3.3.2. Burial Inventories*

Some metal objects went out of circulation because they became parts of burial inventories. As I.Morris has shown in his investigations into the mean distribution of finds in adult burials in Athens in the period of 1125-700 B.C., such burials average 1.7 metal objects in the Sub-Mycenaean period, 1.8 pieces in the Proto-Geometric era, 2.8 in the Early and Middle Geometric periods and only 0.8 in Late Geometric times (fig. 23, 1-2). It is worth noting the dynamics of the distribution of metal objects in Athenian burials: in the Sub-Mycenaean period: 28.9%, the Proto-Geometric : 74.5%, the Early and Middle Geometric : 75% and the Late Geometric period : 37.1% (fig. 23, 3)[526]. Thus, in the second half of the 8th century B.C. there was a considerable reduction in both absolute and relative terms in the number of burials with metal objects in their inventory and the average number of metal objects per burial. These statistics cannot be continued for the period after 700 B.C., because metal articles were practically not used in the burial rites of 700-500 B.C.[527]. The phenomenon of the discontinuation of burial with arms (and of the corresponding provision of metal grave-goods for female burials) is, it has been suggested, closely linked with the "hoplite reform" and the rise of the polis (see below on p. 125 ff.). A.M. Snodgrass mentions that this fact is not matched in other areas of Greece which rejected the idea of the polis (Locris, Achaia and Thessaly continued to produce warrior-burials at later dates)[528].

Certain categories of bronze objects, like statuettes, never formed part of burial inventory, except for rare examples of animal figurines, like the find at Tarentum of a horse figure dated to the third quarter of the 8th century B.C.[529]. Whereas analyses of Attic necropoleis of the Proto—to Middle Geometric periods bear witness rather to the stratification of the upper part of society, the contrast with the Samian Western necropolis of the 6th century B.C. is striking. In Samos rich burials of the 7th century B.C. have also been excavated. In comparison to these, the graves of the following century seem extremely poor, and form a visible contrast with the legendary richness of Samos. They perhaps reflect the law limiting luxuries, which was possibly adopted under Polycrates. However, in spite of the fact stated above, 6th century

526 I. Morris, 1987, 140-151.
527 I. Morris, 1987, 141.
528 A.M. Snodgrass, 1991, 19.
529 C. Rolley, 1986a, fig. 36; R. Thomas, 1992, 30-31.

B.C. burials demonstrate the clear pyramidal structure of society, being represented by seven "rich" graves and approximately eighty others[530].

At the same time, analyses of the average number of metal objects in graves of the Rhodian cemeteries at Ialysos, Kameiros and Vroulia, dating from ca. 625 to 575 B.C. have revealed a large variation in the distribution of metal objects between different types of burials (cremations and vase burials) and various necropoleis, varying from 0.05 items in vase burials at Vroulia to 1 object in vase burials of Kameiros and cremations at Ialysos. Compared to what we find at Kameiros and Ialysos, the Vroulian grave goods are rather poor[531].

### *2.3.3.3. Trade*

Ch.G. Starr considers that there were hardly any established contacts between Archaic craftsmen and merchants who could distribute the whole output of a workshop overseas. Mechanisms for distribution also depended on the character of goods. For instance, articles, such as statues, gold ornaments or vessels made of precious metals, were primarily made to order, whereas other items were manufactured for stock, although few craftsmen would have had enough money or room to store large stocks of products[532]. Analysis of the geographical distribution of Attic black-figured pottery demonstrates that long-term contacts between workshops and merchants barely existed. The shape of vessel, popular in a given area, was the determining factor; merchants therefore acquired vessels of a given form from various workshops[533].

It seems as though the observations made by V.P. Vasilev (concerning the marking of the separate parts of bronze vessels; see above on p. 83 ff.) could make it easy to trace the workings of the trade in bronze objects in the Late Archaic—Early Classical period[534]. Letter marking has been found on bronze vessels from the necropolis of Trebenishte, including a volute krater and phialai, and on a tripod from a tumulus near Staro Selo in Thrace. Finally the same markings have been attested on the krater from Vix. Discussing the particular case of the transporta-

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530 I. Morris, 1987, 148.
531 I. Morris, 1992, 188-189, table 11.
532 Ch.G. Starr, 1977, 85.
533 C. Scheffer, 1988; see also M. Bats, 1989.
534 V.P. Vasilev, 1983.

tion of the Vix krater, R. Joffroy supposes that because of the considerable weight and dimensions of the krater and the need to transport it over mountains it was sent disassembled and accompanied by a craftsmen who assembled it from its separate parts at its destination[535]. The following observation made by M. Egg supports the view that the Vix krater was accompanied by a Greek craftsmen: the repairs were probably undertaken at the end of the journey, i.e. tin soldering could have hardly been undertaken by a local Hallstatt metalworker, given the level of Hallstatt bronze-working[536]. Yet the letters, engraved on the parts of less massive vessels, had according to V.P. Vasilev been carved to prepare the vessels for long-distance overseas transportation. Perhaps, this took place when a big series of a single type of vessel was dispatched. The separate parts were packed according to their types and dimensions: heavy cast pieces being packed separately. This saved space, and besides, such big heavy packages may have also been used as ballast. Thin and fragile vessels could also have been packed separately, for instance, phialai could have been put one inside another. When the ship arrived at its destination a local craftsmen would assemble a vessel, working from the letter marking. Developing his hypothesis, V.P. Vasilev supposes further that vessels of ordinary shapes may have been transported without any markings, because their assembly would have been standard, given the shapes of their bodies and handles[537]. Thus, such vessels were transported to the interior regions of the country, pre-assembled, both separately and in lots[538]. As I have already shown, the hypothesis of V.P. Vasilev, lacks conviction to explain the division of labour between the various centres, and, correspondingly, the presumed form of trade in bronze ware[539].

By what means could long-distance trade overseas have been associated with internal trade? In A.J. Graham's opinion, the latter was usually conducted by the local population, while the inhabitants of settlements, situated near the Greek colonies, acquired small batches of goods, and in its turn, the local population, living further away, bought much larger quantities of goods, and transported and distributed them[540]. It is probable that in this way a trade network was established, which radiated out of the Greek

[535] R. Joffroy, 1954, 53 f.
[536] B. Shefton, 1989, 219, Anm. 54.
[537] V.P. Vasilev, 1983, 184-185.
[538] V.P. Vasilev, 1983, 179.
[539] M.Yu. Treister, 1992, 36; 1993, 381-383.
[540] A.J. Graham, 1984, 8.

*emporia*[541]. At the same time, Late Archaic finds of votive terracottas from a settlement in the interior of Lucania prove, according to Graham, that internal overland trade from the Greek colonies may also have been conducted by Greek merchants, who could make offerings at local sanctuaries[542]. It is rather difficult to give an example, which shows how Greek metal articles were routed and how their transportation was organized in barbarian territory. The finds from the Celtic burial at Vix pose more questions than they give answers. Was the krater carried by sea to Massalia and further transported by river, or was most of the route overland, including the passage over the Alps[543]?

Before ca. 540 B.C. the objects imported into Gaul did not necessary pass through Massalia. After 540 B.C. the role of Massalia and the Rhône valley as a route for amphoras and Attic pottery is clear, however it is held that this is less clear for bronze vases which were more likely to have been conveyed via the Alpine routes[544]. That bronzeware was transported by sea is proved by finds of bronze objects in shipwrecks. Several such examples are dated to the period discussed here. However, there is a problem in distinguishing items of cargo from objects in use on board. For instance, the wreck south-east of Gela, Sicily, dated to the late 6th-early 5th century B.C., was found to contain not only Ionian, Corinthian, Attic and Punic amphoras, black- and red-figured vases, but also a bronze tripod, which, it is suggested, was used on board[545]. Corinthian helmets were found in the wrecks of Giglio and at Camarina[546] but they could also have belonged to crew members. The recently found wreck Pointe Lequin 1A (the island of Porquerolles), dated to the last quarter of the 6th century B.C., includes three bronze statuettes representing a lion (a decoration for a big vase), a warrior and a Silene, which probably formed a part of the cargo of Ionian and Attic black-figured cups, lamps, Attic, Corinthian, East Greek amphoras, and a variety of vases. The figure of warrior is parallelled on an oinochoe in Budapest, which originated from Northern Macedonia and is attributed either to a

541 T.J. Figueira, 1984, 26.

542 A.J. Graham, 1984, 8-10.

543 See, e.g.: W.H. Gross, 1980; J. Driehaus, 1981; A.J. Graham, 1984, 5-6. May be the krater from Vix can not be discussed in frames of trade contacts. For example, F. Fischer considers it as an example of gift-exchange (F. Fischer, 1973; see also I. Wernicke, 1991, 70-71.

544 C. Rolley, 1992.

545 A.J. Parker, 1992, N 441; L. Long et al., 1992, 229.

546 See, e.g. L. Long et al., 1992, 229.

North-Western Greek workshop or a Southern Italian atelier working in the Corinthian style. It has been suggested that the port of destination of this ship was Massalia[547].

The wide diffusion of bronze ware, manufactured in particular centres, in the period in question is demonstrated by the following examples. Probably after the appearance of prototypes of Rhodian origin, dated to 650-630 B.C., in Etruscan workshops of the last third of the 7th—first quarter of the 6th century B.C. the manufacture began of so-called "Rhodian" oinochoai, finds of which are known not only from the territory of Italy, but from Gaul and Iberia as well (fig. 16, 1)[548]. In the second quarter—the middle of the 6th century B.C. the influence of Greek specimens led to the production of bronze ware in Etruria, in particular, of the so-called *Schnabelkannen*[549]. In the first half of the 5th century B.C. the manufacture began of bronze jugs (so-called oinochoai, form 9), which were particularly wide-spread in the second half of that century; such vessels were perhaps made following Etruscan prototypes in Campania and Ionia (fig. 16, 2)[550].

It is interesting to note that the "transfer" of the shapes of Greek vases was continued in a northerly direction. For example, Celtic craftsmen imitated the shapes of Etruscan vessels in particular, for example, the so-called *Schnabelkannen*. H.Born mentions 5-6 Celtic imitations of these Etruscan bronze vases of the late 6th-early 5th century B.C., suggesting the existence of itinerant craftsmen or of a trade in semi-manufactured objects[551]. Besides such technological observations, another basis for this suggestion is a mould for casting of handle attachments with a silene head for a *Schnabelkanne* which was found in the Celtic oppidum of Heuneburg in the upper Danube[552]. However, according to W. Kimmig, the piece was most probably part of the equipment of a Celtic master who had learned his craft in one of the Classical centres[553]. That possibility is not excluded by R. and V. Megaw[554]. As A.-M. Adam has suggested, Celtic craftsmen could also have restored or partly reworked imported Etruscan, Greek and Southern Italian vessels. She also suggests that Celtic craftsmen were mainly inspired by Etruscan prototypes.

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547 L. Long et al., 1992, 220, 224, fig. 40; P. Pomey et al., 1992, 33-35, fig. 35.
548 See: B. Shefton, 1979; cf. C. Rolley, 1987, 336-341; 1988b, 94-97.
549 B. Bouloumié, 1973, 320-324; T. Weber, 1983, 88.
550 T. Weber, 1983, 203-204.
551 H. Born, 1992, 84.
552 H. Born, 1992, 74-75.
553 W. Kimmig, 1972, 349-350.
554 R. and V. Megaw, 1990, 54.

However she further suggests the possibility that oinochoai of the so-called Lenzburg type go back to Corinthian vases dated to between the mid-6th and the mid-5th centuries B.C., which were imitated in the course of the first half of the 5th century B.C. in Italy, presumably at Cumae and through such Cumaean mediation became known in Etruria[555].

Along with metalware, Greek arms were exported in the Archaic period. Greek arms and armour were seen by the peoples, who had settled in Asia Minor—the Lydians, Carians, and Pamphilians—as well as the Cypriots and Etruscans, as prototypes to be imitated. It is no mere chance that finds of Greek armour—for example, of Corinthian helmets—are so diffused[556].

Observation of the distribution of metal objects in the Geometric and Archaic periods reveals the following picture. Already, in Early Greece, to judge from Homer, metal articles were objects of prestige, and were seen as treasure, the value of which ran in descending order from gold to silver and further to bronze and iron. These four metals were associated with four various levels of gods, spirits and human beings[557]. However, the institutions of social control led to a growth of metal objects, which occur as votives in the sanctuaries, partly because of an increase in production, but also due to laws limiting luxury in both everyday life and in burial rites. The number of finds in settlements is, as I have shown above, significantly less than that in sanctuaries, which shows that in the period discussed the manufacture and distribution of metal objects tended to concentrate in the cult centres. However, it should be remembered that in the Archaic period the material value of production was not sufficient to essentially influence the structure of society; this was an era of production and immediate consumption, but not of accumulation of wealth; the difference between wealth and poverty was still minimal[558].

### *2.4.1. The Role of Metals in the Greek Economy of the 8th-6th Centuries B.C.*

The most important roles in the economy of Archaic Greece were played by the following activities: agriculture, warfare and religion;

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[555] A.-M. Adam, 1993, 368-369, note 51 with references; see also C. Rolley, 1990b, 358.

[556] S.-G. Gröschel, 1989, 50-51.

[557] I. Morris, 1987, 140.

[558] V.P. Yajlenko, 1990, 102-103.

of considerably lesser significance were trade and crafts in which slaves or persons without civil rights were as a rule engaged[559]. J.B. Salmon came to the same conclusion and argued until recently for the commonly held view that saw Corinth as a trading and industrial centre. This view found extreme expression in the works of D. Cagan, who considers that by the 6th century B.C. Corinth had developed into a primarily trading city-state. In spite of the fact that the Corinthian economy was much more varied than the economies of many other Greek cities, it was nevertheless basically agricultural[560]. S.C. Humphreys considers Archaic trade in the broad context of exchanges between the Aegean world and the oikumenoi in the course of which the export and import of manpower was of greater significance than any exchange of goods. The latter could not really be subdivided into "trade" proper and the circulation of goods as the result of war, hospitality and gift-exchange[561].

The study of bronze objects from excavations of the Pan-Hellenic sanctuaries, which were in being for centuries, allows us to trace the dynamics of the offering of metal, particularly bronze, votives. A.M. Snodgrass, who has generalized the data available to the mid-70-s, has shown rather convincingly that in contrast to the 11th-9th centuries B.C. the 8th century was marked by a sharp increase in votive offerings. This reflects, without there being any direct dependence, a certain increase in the metal supply both *in toto* and *per capita.* Most metal was used not for production purposes but for dedications to the gods[562].

During this period a qualitative and quantitative increase in dedications over a wide range of sanctuaries of different kinds suggests that an ever greater proportion of personal wealth was being invested by individuals from a wider range of social groups. From Archaic times, at the latest, the right of committing property to temples was the prerogative of the state (although individuals, such as the Alkmaionidai at Delphi, often contributed money or materials [Hdt. V.62.2; Pindar, Pyth. 7]). And this remained the rule outside the East Greek world until changing concepts of kingship and personal rule during the 4th century B.C. encouraged personal investments[563]. 7 of the 10 dedications by states on cauldrons and

[559] Ch.G. Starr, 1977, 79; A.M. Snodgrass, 1980, 131-132.
[560] J.B. Salmon, 1984, 158, 402-403.
[561] S.C. Humphreys, 1978, 169.
[562] A.M. Snodgrass, 1980, 49-54; see also: J. Boardman, 1978, 10.
[563] C. Morgan, 1993, 19.

other bronze vessels from Olympia are dated to the 6th century B.C. Except for one dedication by the Spartans, all other inscriptions belong to communities from the Alpheios valley and Elis, which were the members of the early Olympian amphiktiony[564]. From the Late Archaic epoch onwards votive offerings at sanctuaries become more political in meaning[565].

One should mention that the increased importance of metalworking in Geometric Greece began at least half a century before the establishment of the first colonies. Although it may seem paradoxical, there is no reason to assume an increase in the role of metalworking in the economies of the early city-states: the growth was primarily in the production of votive utensils and statuettes for the sanctuaries. It is notable that the only region of Greece, in which a majority of late 8th – early 7th century B.C. bronze horse figurines have not been found in sanctuaries, but in the context of burials, is peripheral Macedonia[566]. It was estimated for the Classical period that sacral administration absorbed one-fifth of the internal incomes; in the Archaic period this share was perhaps even greater[567]. The Greek states, especially in the Archaic period, did not, according to A.M. Snodgrass, really conduct economic policies in the sense of redistributing state resources[568].

It is noteworthy that workshops, as a rule, adapted themselves to the sanctuaries[569], and this was also typical of other periods in Greek history: temple metal workshops are also known at Olympia, Tegea, Bassae, on Samos and in Sparta[570]. At the same time separate workshops have been excavated at settlements outside sanctuaries, as, for instance, in Eretria and at Ephesus[571]. In papers given by K. Kilian and R. Felsch at the Swedish Institute symposium in Athens and in the ensuing discussion a close connection was affirmed between temples and metalworking. In the Mycenean era, as K. Kilian noted[572], the socio-economic relations between temples and crafts were state controlled. Examples are to be found in the documents of the palace archives of Pylos and Knossos, in which

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564 P. Siewert, 1991.
565 B. Hintzen-Bohlen, 1992, 15-17.
566 See: J.-L. Zimmermann, 1989, 268.
567 A.M. Snodgrass, 1980, 118.
568 A.M. Snodgrass, 1980, 125.
569 *The Greek Renaissance*, 1983, 165; J.M. Hurwit, 1984, 603.
570 N. Yalouris, 1979, 91; *The Greek Renaissance*, 1983, 147; M. Voyatzis, 1986, 194.
571 *The Greek Renaissance*, 1983, 147.
572 K. Kilian, 1983, 146.

smiths and armourers were mentioned,[573] and in archaeological data from Minoan Crete of Protopalatial and Neopalatial periods, from mainland Greece of the Mycenaean period and from Cyprus of the Late Bronze Age[574]). Yet, in the 8th century B.C. there was no such control, although crafts may have developed in conjunction with temples in more or less primitive conditions[575]. O. Murray rephrased the question and reasonably raised the problem of the origins of this new type of dependence. Murray himself proposes two hypotheses: either the temple developed as a centre for exchange or early Greek mercenaries were subordinated to the temple. Dedications by Near Eastern rulers at Greek temples and the existence of armouries speak in favour of the second theory. Archaeological material from the sanctuary at Philia (not all of the production of the workshop was directly connected with the temple) and the existence of 8th century B.C. metalworking shops at settlements speak against it[576]. It is worth noting that in Tamassos on Cyprus the remains of bronzeworking are concentrated in the region of the temple. H.-G. Buchholz explains building activity in terms of mining and metallurgy in the region[577].

I. Strøm's interpretation of the reasons for the introduction of iron *obeloi* by a group of Greek sanctuaries, the association of *obeloi* with a proto-monetary-value system (see below on p. 131) imply that the Greek sanctuaries had an independent economy and a high level of organization in the late 8th and the early 7th century B.C. Furthermore, she assumes that Near Eastern bronze vessels found at some sanctuaries were not votives, but rather acquisitions arranged collectively by groups of related sanctuaries[578].

Publications of bronze tripods from Olympia[579] and Delphi[580], and votive figurines from Olympia[581], as well as of other materials,

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[573] G.F. Polyakova, 1983, 72, 74; L. Neesen, 1989, 22-23, Anm. 25; J.S. Smith, 1991, 316.

[574] Some finds give evidence of a symbolic kind for what may be seen as a divine protection of the copper production; see D. Evely, 1988; R. Hägg, 1992, 29-32.

[575] See, e.g. C. Reinholdt, 1987, 200: "Während in der Bronzezeit die an Heiligtümer angeschlossenen metallverarbeitenden Betriebe Eigentum und reine Zulieferbetriebe für die wirtschaftliche Potenz der sakralen Institutionen darstellten, manifestiert sich im Schaffen der früheisenzeitlichen Metallwerkstätten mit ihren jetzt erstmals unterscheidbaren regionalen Stil- und Kunstausserungen ein vielseitiges und wirtschaftlich heterogenes Handwerk".

[576] See: A.Yu. Sogomonov, 1988, 239.

[577] H.-G. Buchholz, 1985.

[578] I. Strøm, 1992, 50-51; 1992a.

[579] M. Maass, 1978.

[580] C. Rolley, 1979.

[581] W.-D. Heilmeyer, 1979.

provide general proof for the conclusions of A.M. Snodgrass[582]. For instance, of 266 intact and fragmentary bronze tripods found at Olympia (excluding additional figures and iron tripods), according to the data published by M. Maass[583], 68 are datable to the 9th century B.C., but 198, i.e. approximately three times as many, to the 8th century B.C. A similar distribution is shown by the discs, which were probably decorations for belts, found at Olympia. Of these materials, which were published by B. Fellmann[584], 89 objects are dated to the 9th – mid-7th centuries B.C., but less than 20 to the 9th century B.C. and more than 50 to the next century. Nevertheless it is erroneous to think that the sharp increase in manufacture of all categories of metal objects began in the early 8th century B.C. In this sense it is important to consider the chronology of the distribution of bronze ornaments, among which the most popular were pendants and pins. Analyses of pendants from mainland Greece, including finds from the territories of modern Albania and Yugoslavia as well as from the islands of the Ionian Sea, provide grounds for the identification of regional peculiarities. For example, on mainland Greece a sharp increase in the numbers of objects and in the variety of shapes of bronze pendants took place in the Late Geometric period, i.e. in the second half of the 8th century B.C.[585]. The corpus of pins, originating from the Peloponnese, allow me to use statistical data for both the Geometric and Archaic periods. Regrettably, in the conclusion of her monograph, I. Kilian-Dirlmeier[586] has not made in full use of her numerous and well systematised material, but only mentioned the variety of shapes and the diversity of Geometric articles in comparison to those of the previous period and the fact that at that time along with their direct function as objects of costume and parts of burial inventory pins had started to be used as votive offerings at sanctuaries. This transition, as C. Rolley has stated[587], was typical of many other categories of bronze objects. Meanwhile, published data shows that 3073 pins are datable to the Geometric period, while only 1569 can be dated to the Archaic epoch, which, on first sight, would seem to prove Rolley's conclusion that the manufacture of pins declined in the 7th-6th centuries B.C. in com-

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582 P. Cartledge, 1982, 290.
583 M. Maass, 1978.
584 B. Fellmann, 1984.
585 I. Kilian-Dirlmeier, 1979, 259.
586 I. Kilian-Dirlmeier, 1984, 296-298.
587 C. Rolley, 1988, 346.

parison to the 9th-8th centuries B.C. Nevertheless, most types of Geometric pins ID4,6; IIIB; V-XVII which comprised more than 15% of all Geometric pins, are from the Late Geometric period alone. At the same time, the manufacture began of the most numerous type of Geometric pin, decorated with many "heads", which also continued into the first half of the 7th century B.C. This type which accounts for more than 40% of all the objects attributed by I. Kilian-Dirlmeier to the Geometric period. Thus, almost two thirds of the pins, generally dated to the 9th-8th centuries B.C., can be pinpointed to the Late Geometric – Early Archaic periods.

As A.M. Snodgrass has stated, metalworking in the 8th century B.C. was characterized by use of large amounts of iron and bronze, modest amounts of gold and silver, and very small quantities of lead[588]. Nevertheless, regional varieties should, in my view, be stressed. First of all, what is true for Olympia and Delphi is not at all typical, for instance, of the materials from the Kabeiros sanctuary in Boeotia. At this sanctuary were found 534 bronze and lead bull figures, dating from the late 10th century B.C. to the Classical period. The groups, identified by B. Schmaltz on the basis of stylistic analysis, allow a suggestion to be made concerning the dynamics of the activity of workshop production. The highest level of activity is attested in the 9th and 7th-6th centuries B.C. Half as many figures are dated to the 8th century B.C., than to the 9th century B.C. The proportion of lead statuettes is extremely high. They account for approximately 75% of the total, but this was later reduced a little to about 60%[589]. Thus, one should add to the conclusions of A.M. Snodgrass the regional varieties in the development of metalworking and the use of various materials and alloys, which existed in the 8th century B.C. These are shown by analysis of bronze Geometric tripods. For instance, Argive craftsmen made alloys with insignificant, although consistent, additions of tin; this homogeneity of alloys is also attested in Attic products, which are characterized by the presence of arsenic admixtures, pointing to the usage of Laurion ores. At the same time, articles manufactured in Corinth after 760-750 B.C. are characterized by high proportions of artificial tin additives and the absence of stable concentrations of tin, lead, iron and arsenic in alloys[590].

An obvious stimulus to the development of bronzeworking in

[588] A.M. Snodgrass, 1980, 49-50.
[589] B. Schmaltz, 1980.
[590] E. Magou et al., 1986, 133.

Greece was provided by improvements in military technology, a significant stage in which was the creation of hoplite infantry in the major Greek centres of the 7th century B.C. This process, which started in about 700 B.C., was a gradual one and the transition to equipping warriors with cuirasses, shields with bronze overlays, greaves and helmets, spears and swords took half a century at least[591]. The exact chronology of this process is unknown; one suggestion, based on the vase drawings, may as was recently shown, be erroneous, because these images may have been influenced by themes from Neo-Assyrian palace reliefs[592]. At the same time, this development was associated with an increase in the economic power of the Greek city-states, which allowed the richest of them to afford armies, made up of hoplites equipped at their own expense. However, this occured in exactly the 7th century B.C. and not earlier, not because of a lack of bronze, which was used in the previous century for casting massive cauldrons to be dedicated in the sanctuaries. Perhaps this should be explained by the desire of the Greek aristocracy for domination on the battlefield and, may, to a certain extent, be an imitation of the equipment, on one hand, of warriors from the Italic tribes, on the other hand, of the Eastern Empires, like Assyria[593]. However, there are differing views concerning the reasons behind the "hoplite revolution". The existing theories and proposed periodizations may be divided into two groups. A.M. Snodgrass put forward a hypothesis of gradual transition, involving two phases: the spread of panoply; the creation of the hoplite phalanx; P. Cartledge defends the hypothesis of the "quantum leap", which is characterized, in his view by the appearance in ca. 700 B.C. of the hoplite shield. There are corresponding views of its social role: was the phalanx created by the tyrants, as is thought by adherents of the first hypothesis, or, on the other hand, did as P. Cartledge contends, the phalanx "create" the tyranny?[594].

Most recently V.D. Hanson has maintained that because the adoption of the panoply represented a technological, rather than

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591 A.M. Snodgrass, 1967, 57; cf. J.K. Anderson, 1970, 14-39; 1991, 16: a time of development extended from the first to the third quarter of the seventh century B.C.; V.D. Hanson, 1991, 65; E.L. Wheeler, 1991, 129: between 725 and 675 B.C.; see also about the Homeric arms and armour: P.C. Bol, 1985, 41-47.

592 A.C. Gunter, 1986.

593 A.M. Snodgrass, 1967, 49; 1980, 99-105; S.-G. Gröschel, 1989, 33.

594 P. Cartledge, 1977; cf. J.B. Salmon, 1977; J.F. Lazenby, 1985, 185, note 17, 24; P. Ducrey, 1986, 61. See a brief discussion of the view concerning the hoplite reform: V.D. Hanson, 1991, 65 ff., 80-81.

a tactical, breakthrough, it must also be seen as a purely military, rather than a political or social, phenomenon. The acquisition of new equipment on a wide scale by small landowners was a reflection, not the cause, of their economic prosperity and growing political independence. It was simply an illustration that most small farmers who fought in the phalanx had already "arrived" and had now gradually acquired the experience, expertise, and wealth to manufacture superior arms for their specialized needs as shock troops[595].

Nevertheless, it would appear that the very development of an aristocracy in the social structure of early Greek society, and the development of a group who craved for gold and ivory from Egypt, Phoenician textiles, and Etruscan bronzes[596] should have stimulated an interest in acquiring sources of metal and in developing metalworking. War was an important instrument of economic distribution. It is no accident that Aristotle (Pol. 1256b 23) described it as a way of acquiring property[597].

As A. Snodgrass has stated, hoplite armies shaped rather than merely echoed the history of the polis. The existence of hoplites is the clearest a posteriori proof of the existence of the polis[598].

The equipment of a hoplite demanded a large amount of metal, primarily bronze, and was expensive. There are different views concerning the weight of panoply, but the entire ensemble may have weighed more than 30 kg[599]. In Athens in the late 6th century B.C. a panoply could cost at least 30 drachms, which was a substantial sum[600].

In spite of the fact that the citizen of a polis had to provide himself with military equipment[601], the state was undoubtedly interested both in the existence of reliable deposits of raw materials and workshops. In the 7th century B.C. this was true first of all of Corinth, Argos, Sparta and Crete. It is worth mentioning J.B. Salmon's interpretation of buildings, when he discusses three building

595 V.D. Hanson, 1991, 77-78.
596 S.C. Humphreys, 1978, 167.
597 See G. Shipley, 1993; T. Rihhl, 1993. Cf. the point of view expressed by A. Jackson: Dark age warfare, to judge from Homer, may have been more often about defending one's honour and attacking that of others- about pride and martial prowess- than about greed and profit, though that motive was doubtless often present and possibly at times dominant (A. Jackson, 1993, 74-75).
598 A.M. Snodgrass, 1991, 18-19.
599 See V.D. Hanson, 1991, 78, note 1 with a survey of various calculations.
600 A.H. Jackson, 1991, 229.
601 S.-G. Gröschel, 1989, 33-36.

periods of the Late Geometric – Late Corinthian periods, excavated on the site of the Sacred Spring at Corinth. In the second stage of its existence, which ended with its destruction in ca. 640 B.C., the building was re-planned and two rooms were converted into a courtyard with a furnace, where the remains of metal production, including a mould for casting spearheads, were found[602]. J.B. Salmon links the establishment of a metalworking shop (an armoury?) in Corinth somewhere in the first half of the 7th century B.C. with the "hoplite revolution". Was the number of workshops increased with a growing requirement for arms and armour, or was it a process of change in the specialisation of workshops?

The calculations of A.M. Snodgrass, based on the statistics of the chronological distribution of bronze cauldrons, the Orientalizing attachments of cauldrons and various items of arms and armour—helmets, cuirasses, shield overlays—all found at Olympia, prove that by the end of the first quarter of the 7th century B.C. the manufacture of votive utensils had ceased. By contrast, offerings of armour, which began in the first half of the century, reached their peak in the second half of the 7th-6th centuries B.C.[603].

A.M. Snodgrass, in explaining the discontinuation of male burials with arms and female burials with metal grave-goods in certain areas of Greece from ca. 700 B.C., has linked this phenomenon with the "hoplite reform" and the rise of the polis, and maintains also that it was associated with one more innovation, namely a sharp increase in dedications, of exactly the same classes of objects in the sanctuaries—"the communal superseding the personal"[604].

Snodgrass' statistics are based on materials published in the period 1950-67. Since that time a considerable body of material has been pubished: the second part of the corpus of Orientalizing cauldrons by H.-V. Herrmann[605], as well as the corpus of Argive shields by P.C. Bol[606], a general publication by W. Gauer of bronze vessels other than Orientalizing cauldrons[607] and an account of bronze greaves by E. Kunze[608]. And 143 new finds of shield overlays can now be added to the 84 published in 1950. W. Gauer, for instance,

[602] Ch.K. Williams II, J.E. Fisher, 1971, 5-10; cf. J.B. Salmon, 1984, 99.
[603] A.M. Snodgrass, 1980, 105-106; P.C. Bol, 1985, 48.
[604] A.M. Snodgrass, 1991, 19-20.
[605] H.-V. Herrmann, 1979.
[606] P.C. Bol, 1989.
[607] W. Gauer, 1991.
[608] E. Kunze, 1991.

has published more than 2000 items of bronzeware, which had hitherto only been partly published in separate works.

However, if the data about the chronology of protomes attached to Orientalizing cauldrons, published in a synchronistic table by H.-V. Herrmann, is taken into consideration, the following picture emerges[609]. Only four out of 96 protomes are to be dated to the last quarter of the 8th century B.C. The peak of their manufacture should be dated to exactly the first half of the 7th century B.C.: 57 of the protomes are dated to that period. Furthermore, a gradual reduction in production activity took place: 29 pieces are dated to the second half of the century, while only 6 are of the first quarter of the 6th century B.C. It is thus difficult to maintain that the manufacture of votive utensils ceased in the first half of the 7th century B.C. It is more likely that there was a general increase in the manufacture of bronze artefacts but not a change from one category (massive bronze utensils) to another (armour). Moreover, if the distribution of all the cauldron protomes listed by H.-V. Herrmann is taken into consideration, the following picture is revealed. The total number of pieces is 433, only 24 of which have no known provenance. Along with Olympia, where 118 articles have been found, the main source of finds is Samos, where 192 protomes have been unearthed. The finds from Samos have a different chronological distribution to those from Olympia. Only three articles belong to the early group of hammered protomes (13 in Olympia, total : 19) which may be dated to ca. 725-690 B.C. The griffin and lion protomes of the middle group, both hammered and cast, are dated to 690-670/50 B.C. 54 of 96 finds come from Olympia and only 18 from Samos. Protomes of the late group, dated to 670/50-620 B.C., are represented by 70 copies and were found in approximately equal quantities in Olympia and Samos: 29 and 22 respectively. The proportion of Samian finds increases sharply in the series of late cast protomes of all four groups, dated to 620-575 B.C. 163 of 224 finds come from Samos, whereas only 16 are from Olympia[610]. However, we should remember the considerable variety in the dimensions and weights of protomes. Tripods, dedicated at Greek sanctuaries, also usually vary in height from less than 10 cm

[609] H.-V. Herrmann, 1979, 154.

[610] H.-V. Herrmann, 1979, 155-167. Most recently a review of the finds of Greek and Oriental cauldron attachments was delivered by O.W. Muscarella (1992, 16-45), who mentions 88 finds of siren cauldron attachments, about 40 pieces of winged bull cauldron attachments and over 450 griffin protomes.

to 3.5 metres. Some of them were colossal. For example, the piece described by Herodotus (IV. 152), which was decorated with griffin protomes, and manufactured in the 7th century B.C. in Samos, cost 6 talents. We should also mention six gold cauldrons, each weighing 5 talents, offered at Delphi by Hyges (Hdt. I. 14) and a bronze cauldron with six figures on its rim made by the Laconians for Croesus (Hdt. I. 70). The colossal dimensions of these votives seem at first sight improbable, however they are proven by finds of griffin protomes of the 7th century B.C. at Olympia. Their heights vary from 65 to 85 cm. Analysis of three griffin protomes from the museums of Olympia, Athens and New York attests not only to common stylistic features, but also to a single manufacturing technology, proving that such votives had probably been made by one craftsmen[611].

Thus, analysis of all known cauldron protomes shows not a decrease in their production, but, on the contrary, an increase in the second half of the 7th – first quarter of the 6th century B.C., although the growth in production was associated primarily with Samian workshops.

A similar, if not even sharper, increase in manufacturing is shown by analysis of the chronological distribution of other categories of bronzeware found at Olympia. W. Gauer included in his catalogue 587 items of intact and fragmentary cauldrons and basins with movable handles, approximately 566 of which are dated to between the Geometric and the pre-Hellenistic period. Among these finds only 2 pieces are dated before the mid-7th century B.C. A majority of the finds has been identified as Archaic, dating to the second half of the 7th and the 6th century B.C.[612]. We should also take into account the diversity of the shapes of bronze vessels established in the Early Archaic period, as proved by finds from Olympia[613].

As in the example cited above of the chronology of distribution of bronze votives from the Theban Kabeirion, a detailed analysis of the chronology and spatial distribution of cauldron protomes compels us to refrain from a synonymous similar evaluation of trends in the development of Greek metalworking, and stresses once more the regional peculiarities of various centres.

Equally revealing are changes in the treatment of the tripod

[611] C.C. Mattusch, 1990.
[612] W. Gauer, 1991, 178-235.
[613] W. Gauer, 1991, 235 ff.

during the Archaic period, a symbol with particular elitist associations. At certain sanctuaries (such as Delos) tripods continued as personal dedications, yet at Olympia, after a brief vogue for Orientalizing styles during the first half of the 7th century, tripod dedications declined and disappeared. However, at Delphi and in several city centres (Athens included) tripods came to be used mainly as symbols of state or state-approved activities[614].

Furthermore A.M. Snodgrass, in putting forward his hypothesis, contradicts himself on a methodological point: while rejecting the idea of economic politics in early Greek city-states, he tries to come to an rational explanation for the appearance of metal for the manufacture of armour. He perhaps holds *a priori* that the sources of metals in the first half of the 7th century B.C. could not have increased.

Besides, it seems impossible to maintain that there was a sharp increase in, for example, the production of armour in the first half of the 7th century B.C. Only the 39 greaves dating from the Early Archaic period are less than half the number of those dated to the High Archaic (98 items) and Late Archaic periods (86 pieces). It is worth noting that finds from Olympia predominate in all of the three chronological groups discussed, comprising ca. 80-85% of the total[615]. To judge from the chronological distribution of greaves one can argue that the growth in the manufacture of greaves dates to the first third of the 6th century B.C.

Presumably it was Greece's external contacts, in the first place with the Near East, that brought about the establishment of a proto-monetary-value system. I. Strøm associates the appearance of iron *obeloi* with the introduction of Near Eastern banquets into Greek sanctuaries shortly before 700 B.C. In Greek settlements, as well as in Greek sanctuaries, the iron *obeloi* used for banquets came in sets of six and were of a standard make, but only the sanctuaries seem to fulfil the requirements of continued use into the 6th century B.C. and a wide distribution pattern[616].

It was most probably in ca. 600 B.C.that the Greek cities of Asia Minor: Ephesus, Miletus, Halicarnassus, Theos, Phocaea, Cyzicus etc. began coining in electrum. This is the most widely accepted date for the appearance of coinage, although it has been suggested that this should be corrected to the early 7th century B.C. while

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614 C. Morgan, 1993, 27.
615 E. Kunze, 1991, 81-116
616 I. Strøm, 1992, 50.

M. Vickers has recently proposed dating the beginning of coinage to the 540s B.C.[617]. Some scholars think that the reason for the adoption of coinage was its political function, primarily in stressing the power and independence of the *poleis.* They consider that its economic functions were secondary and even incidental by comparison to its political ones[618]. There are different variants of the "economic" hypothesis, the most convincing of these being one recently proposed by R.W. Wallace[619]. Electrum coins of the first half of the 6th century B.C. varied considerably in composition; this was probably due to the fact that the separation of natural electrum into gold and silver by the cementation process was discovered later on, in about the middle of the century. The establishment of coinage served to stabilize the price of electrum as a metal and was undertaken in most cases by the state, which made a profit from it[620]. The invention of coinage should thus have stimulated the process of mining for precious metals. In order to provide coinage it was necessary to possess supplies of metal, thus it is no mere accident that electrum coinage appeared in Asia Minor, where deposits of electrum were mined in the period discussed here. The existence of large stocks of metal was perhaps a necessary condition and probably a reason for early electrum coinage[621]. The fact that the mining of precious metals was considered in antiquity to be the basis of prosperity and state power is proved by the well-known passages from Strabo (I. 2.39; XV. 5. 28).

Although the silver coinage which began in the second quarter of the 6th century B.C. in Aegina[622], and became wide-spread after the mid-6th century B.C.[623], was established to serve the same purposes as electrum coinage, rather different premises underlay its issue. In particular, not all the centres which produced silver coinage, including Aegina[624], were able to exploit their own sources of silver; they coined imported metal or, to judge by metal analyses, used coins from other centres as sources of raw metal[625]. However, silver coinage, like that of electrum, should have stimu-

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[617] See: J.H. Kroll, N.M. Waggoner, 1984; R.W. Wallace, 1987, 385, note 1; I. Strøm, 1992, 41, note 4 with references.

[618] C.M. Kraay, 1964; A.M. Snodgrass, 1980, 135.

[619] R.W. Wallace, 1987.

[620] C.M. Kraay, 1976, 23-27; R.W. Wallace, 1987, 393.

[621] R.W. Wallace, 1987, 395-396.

[622] J.H. Kroll, N.M. Waggoner, 1984.

[623] C.M. Kraay, 1976, 35.

[624] T.J. Figueira, 1981, 144-149.

[625] J.B. Salmon, 1984, 172-173.

lated the process of mining. In any case, there are reasons to suggest that the increase of the iron-silver ratio to ca. 10% is linked with the establishment of silver coinage[626].

Colonization was one of the most important reasons for economic development in Archaic Greece. The widening of the economic life of various Greek centres, including the most developed colonies, marked the beginning of a new phase of economic activity in the 7th-6th centuries B.C. With the onset of this phase the Greek economy reached a qualitatively new stage as a result of internal developments in the means of production and of large previously unused resources of people and raw materials in the newly colonized regions. In some centres Greek economic life achieved a Classical character: craftsmen started the mass manufacture of goods, which led to a more significant development of trade with the appearance and diffusion of coins. Whereas previously there had been only a few centres, which led in the field of production, in the Archaic period dozens of colonies and Greek mother-cities took an active part in the economic development of the Greek world[627].

Colonization and economic change considerably stimulated the socio-political development of Greece. In the course of the 7th century B.C. a new type of government, the tyranny, appeared in many of the Greek towns[628]. The separation of a self-willed strong personality from an aristocratic society, a symptom of its incipient decay, led to the development of tendencies which favoured supremacy and the accumulation of wealth. The spirit of imperialist power politics, which emerged in the city-states of the 5th century B.C., was born of the tyrants. Nevertheless, even though some of these tyrants, for instance, the Cypselids or Peisistratos, played a role in the history of colonization, Greek tyrants could not on the whole be described as having foreign policies[629].

The problem of early tyranny can be formulated in the following way. Did the tyrants of the 7th-6th centuries B.C. take a leading role in "economic" policy and did tyranny, as a new form of government, influence the development of mining, metallurgy and metalworking in Greece?

Analysing the relation between foreign policy and foreign trade in Archaic Greece, I. Hahn states that the economic embargo of

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626 P. Courbin, 1959; H.A. Cahn, 1960a.
627 V.P. Yajlenko, 1990, 80-81.
628 See: H. Berve, 1967.
629 H. Berve, 1967, 164-165.

Corinth by Athens did not lead to political conflict. Athens under Peisistratos was a Corinthian ally and later Corinth in fact helped Athens to prevent the forcible return of power to Hippias (Hdt. V. 92). The trade in Attic vases in Southern Italy and Etruria was a private initiative. It may not have acquired a political dimension because the vases were transported either by Corinthian, or Corcyrean or Ionian ships and, therefore, the trade itself took the form of "joint ventures", which as such did not impinge on Corinthian interests. Such "joint ventures" between city-states probably took various forms, including specialization in the manufacture of certain goods; thus, in this period cooperation in foreign trade was probably more important than confrontation. All this led to a considerable depoliticisation of external trade in the Greek spheres of influence[630].

Criticizing the standpoint of P.W. Ure, who characterized the early tyrants as "merchant princes", P. Oliva maintained that it is impossible to make any comparison between Archaic Greece and England of the Tudor era. Yet he believes that one cannot underestimate the economic agendas behind the establishment of early tyrannies, which won ground in the economically most developed regions of Greece[631].

Since the Homeric period the Greeks had considered piracy and cattle-raiding as important sources of income, and may even have made no distinction between warfare and raiding for loot[632]. It is worth remembering that according to a law attributed by Gaius to Solon (47.22.4) some ventures in piracy were inside Athenian law[633]. We should also note an attempt by Solon to regulate the export trade of Athens: "Of the products of the soil, he allowed oil only to be sold abroad, but forbade the exportation of others; and if any did so export, the archon was to pronounce curse upon them, or else himself pay a hundred drachmas into

630 I. Hahn, 1983, 36.

631 P.W. Ure, 1906; cf. P. Oliva, 1959, 231.

632 W.K. Pritchett, 1991, 312 ff.; cf. A. Jackson (1993, 70ff.) who maintains a clear distinction between war and raids in Dark Age Greece, however, stating: "Even if we subtract the gold, silver, and bronze from the booty of actual Dark Age warriors, deny them their metal armour, reduce drastically the ransoms they charged each other, imagine only rather small walled or unwalled towns under siege, and attribute some of their concern with booty to a literate origin, we may still be sure that greed for booty and ransom flourished in Dark Age Greece.

633 E. Ruschenbusch, 1966, 98, F 76a; W.K. Pritchett, 1991, 325-326.

the public treasury" (transl. by B. Perrin) (Plut. Sol. 24. 1)[634]. It is said that this Solonian law prohibited the export of agricultural products from Athens[635], yet it is not clear whether it also applied ores and metals. In any event, the scale of metal extraction at Laurion in the early 6th century B.C. was most probably not very significant, although copper was probably exported to Egypt in the 8th-7th century B.C. (see above on p. 23 f.).

In Corinth, for instance, many features, characteristic of an economic development of a type which was unusual for Greece were already being cultivated a century before the Cypselids came to power[636]. As in Corinth, the development of crafts, including metalworking, preceeded the establishment of the tyranny of Polycrates in Samos[637]. However, the maintenance of an army, the construction of a fleet, and the scale of public building under the tyrants[638], should have promoted the development of crafts, including metalworking. In the third book of the "Samian chronicles" of Alexius it is recorded that Polycrates invited craftsmen, offering them generous loans[639]. There are certainly no grounds for describing the policies of the early tyrants as "economic", however it is obvious that certain elements of an economic policy had already emerged. Anyway, one should recognise at least the "unintended economic effects" of some of Polycrates' measures, for instance, the transition to the Lydian-Milesian standard of coinage in ca. 525 B.C.[640] or the striking of counterfeit lead coins plaqued with gold foil to bribe the Spartans (Hdt. III. 56, 2)[641]. Shortly before the fall of Sardis in 546 B.C. the Samians had stolen a valuable krater, which had been sent by the Spartans to Croesus. A year before the same fate befell a suit of armour sent to Sparta by Amasis (Hdt. I. 70; III. 47)[642]. In 525 B.C. the Spartans used these episodes to justify their war with Polycrates[643]. In order only to equip his

[634] E. Ruschenbusch, 1966, 93, F 65.

[635] E. Ruschenbusch, 1966, 93. See about the reforms of Solon and Attic trade: K. Tausend, 1989, 1-9.

[636] J.B. Salmon, 1984, 61 ff.; P. Barceló, 1993, 155, Anm. 552 See about the chronology of the Cypselids: P. Barceló, 1993, 153, Anm. 543.

[637] G. Shipley, 1987, 85-89.

[638] See: J. Boardman, 1978, 63; L. Neesen, 1989, 44-45; P. Barceló, 1993, 159-160, Anm. 572; K. Mieth, 1993, 41 ff.

[639] See: G. Shipley, 1987, 83.

[640] G. Shipley, 1987, 82.

[641] J. Barron, 1966, 17; G. Shipley, 1987, 85.

[642] G. Dunst, 1972, 122-123.

[643] G. Shipley, 1987, 72.

triremes with rams Polycrates had to obtain at least 8 tons of copper (see below on p. 140), i.e. a volume supposedly comparable to one year's production from the mining region on Cyprus.

The activities of the Athenian tyrant Peisistratos should be specially analysed. Their economic effects could scarcely be described as unintentional. Like other Greek tyrants, Peisistratos promoted the development of crafts and trade in Athens, gave a lead to the early city-building programme, which outlined the features of the future city and enlisted craftsmen of all areas of specialisation: sculptors, architects, masons, metalworkers etc.[644]. The adoption of the tetradrachm, which soon gained popularity, favoured the growing role of Athens as a trade centre; from the mid-6th century B.C. Attic pottery was driving out Corinthian ware from the markets[645]. One should not see this influence in simple terms, for instance in large-scale bronze sculpture 6th century B.C. Athens was appreciably behind the Pan-Hellenic sanctuaries at Olympia, Delphi[646].

After his second expulsion from Athens Peisistratos agreed with the King of Macedonia to colonize the site of Raikelos in the north-western part of Chalcidike, where he obtained gold and silver mines in the Pangaeus mountains (Hdt. I. 64; cf. Arist. Ath. Pol. 15. 2). This formed the basis of both his future prosperity and military power[647]. However, it is not clear whether Peisistratos had founded a specific settlement in the region of Pangaeus and who were the settlers: perhaps, they were supporters of Peisistratos, who had left Attica with him[648]. It is thought that Peisistratos' drawing of income from the mines did not mean that he owned them. It is possible that they belonged to the Thracians and that the Athenian tyrant rented some of them, making a mutually beneficial treaty. The exploitation working of the mines was conducted by hired workers, perhaps, local inhabitants[649].

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[644] See about Peisistratos, e.g. H. Berve, 1967, 47-63, 543-554; P. Barceló, 1993, 161-165; about building programmes: F. Kolb, 1977; P. Barceló, 1993, 271-272; K. Mieth, 1993; about Ionian sculptures at Athens: D. Viviers, 1992, 101-102.

The use of bronze details in architectural decorations is proved by the find of bronze plates, which decorated the capitals from Samian Heraion and other similar finds mentioned by H. Kyrieleis. See: H. Kyrieleis, 1988a.

[645] M. White, 1955, 205; L. Neesen, 1989, 64-65, Anm. 78; H.A. Shapiro, 1989, 2-17.

[646] See: H.A. Shapiro, 1989, 10.

[647] F. Schachermeyer, 1937, 119; H. Berve, 1967, 50-51; M. Stahl, 1987, 201 ff.

[648] P.J. Rhodes, 1981, 207.

[649] T.D. Zlatkovskaya, 1971, 100-101, 118-119, 124.

B.M. Lavelle has recently suggested that the Peisistratids could evidently never have been appreciably sustained by their Thracian revenues, and it is very doubtful whether the tyrants ever had direct access to the mines in Pangaeus or anywhere else in Thrace. There is no archaeological trace of even a temporary Peisistratid settlement in the area of Mt. Pangaeus. Peisistratos' exploitation of the Strymon area was, like his settlement at Raikelos, temporary and only moderately successful. Lavelle questions whether Peisistratos owned the mines, but rather worked them through lease or some other arrangement. In this case, his control of them and profits from them will obviously have ceased with his departure. But even if Peisistratos had somehow managed to acquire mines, how, after he and his party left the Strymon, could the tyrant or his sons after him have ensured a flow, let alone a reliably munificent flow, of gold and silver from those parts?[650].

According to B. Isaac, who examined the passage in Herodotus, the fact that Peisistratos continued to receive substantial profits from Thrace even after his second return to Athens and the silence of sources about his conflicts with the Thasians and the Thracians, indicate that Peisistratos had made a fortune as a middleman for the Thracians, who were the owners of the mines. He adopts the view, expressed early in the century by P. Perdrizet and repeated since then by other writers, that after that time the attention of Athens was drawn to Pangaeus[651]. Even in the late 6th century B.C. the desire to gain possession of the mines of the Pangaeus-Strymon area may have led to conflicts between various Greek city-states and the Thracians.

Hestiaeos, the Milesian tyrant, who saved the Persian troops on their way home after the Scythian campaign of 514/13 B.C. asked Darius to give him as a reward, as Herodotus mentions (V. 11), Mirkinos in the land of the Edonians, where he wanted to found a colony. Megabasus, who told Darius about the plans of the Milesian tyrant and explained the importance of the region, stressed in the first place the abundance of wood for shipbuilding and in the second the silver mines. Archaeological material from the Strymon valley provides evidence, according to B. Isaac[652], of Greek expansion in that region, which was accompanied by military conflicts, which are not reflected in the narrative sources: in the 6th century

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650 B.M. Lavelle, 1992, 88-89; 1992a, 21-23.

651 P. Perdrizet, 1910; P.J. Rhodes, 1981, 207; B. Isaac, 1986, 14-15.

652 B. Isaac, 1986, 6-8.

B.C. Greek settlements were founded in Amphipolis and its vicinity. A late 6th century B.C. inscription from Eion mentions a certain Tokes who perished in the battle of Eion. This warrior, who bears a Thracian name, was honoured by the Parians. The Parian settlements in the Thasian *peraia* were settled soon after the colonization of Thasos; the reason for this was perhaps the gold and silver ores of Pangaeus[653].

P. Perdrizet and W. Ehrenberg have independently given interpretations of the passage in Herodotus (VI. 132) about Miltiades' expedition in 489 B.C. against Paros after the battle of Marathon. Miltiades "asked the Athenians to give him seventy ships and money, not telling them what land he intended to make war against but saying that he would make them rich, if they would follow him; for he would lead them against a land whence they should easily have gold in abundance"(transl. by E. Powell). If, as is supposed, this was an expedition to conquer Thrace with the mines of Pangaeus and Strymon, it was desirable to first conquer the Thasian mother city, Paros. As B. Isaac maintains, the find of Tokes' gravestone proves Parian activity in the region in the late 6th century B.C. and lends considerable credibility to this suggestion about the aims of Miltiades' expedition[654].

Thus, in the middle to the third quarter of the 6th century B.C. the activities of some Greek tyrants betray features of an economic policy, or some of their measures led to obvious economic effects[655]. The desire of Greek tyrants to possess objects in precious metals led to military conflicts, which, correspondingly, demanded the manufacture of arms and armour and may have contributed to the trend for the control of the distribution of metals. To my mind, this is also proved by the dynamics of production and by the development of the technology for manufacturing bronze articles, particularly armour.

The following observations may be obtained on the basis of analyses of the chronological distribution of various types of helmets. 20 out of 115 Illyrian helmets, listed by H. Pflug, belong to

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653 B. Isaac, 1986, 13.

654 H. Berve, 1967, 173f., 616f.; B. Isaac, 1986, 18-19; see also: W.K. Pritechett, 1991, 326-327; cf. E. Stein-Holkeskamp, 1989, 187ff.; L.-M. Günther, 1993, 81: "Bedeutsam..wie der gewählte Stratege einer Polis mit deren Streitmacht einen geradezu privaten Rachefeldzug durchführte, wie also individuelles Prestige dafür ausgenutzt wurde, im Namen und mit den Mitteln des Staates den Vorrang der eigenen Person, der eigenen Familie zu erweisen". K.H. Kinzl (1976) presents an analysis of historical sources about the Miltiades' expedition.

655 See, e.g. H. Berve, 1967, 20; P. Barceló, 1993, 270-271.

the first chronological group of the late 8th – late 7th century B.C., 18 are dated to the late 7th – mid-6th century B.C., whereas 77 are dated to the mid-6th – 4th centuries B.C., including 30 belonging to the second half of the century[656]. There are 85 helmets known of the Apulo-Corinthian type, dated to the late 6th-4th centuries B.C. Chalcidian helmets appeared in the last third of the 6th century B.C. Regrettably on the basis of the materials published in a thorough work devoted to ancient helmets: "Antike Helme" (Mainz, 1988) it is still difficult to offer a statistical picture of the chronological distribution of the ca. 550 Corinthian helmets known to date. However the study of the technology of these helmets proves with certainty that there was a change in the helmets of the third chronological group, dated to after 530 B.C. The strengthening of the metal allowed a reduction in the weight of the helmets, by reducing the thickness of the bronze sheeting[657]. This may have been linked not only to an improvement in the shape of the helmets, but also to a need to economize on metal, as a result of increased output. A passage from Herodotus (IX. 28.3) gives an idea of the scale of production: 5000 Corinthian hoplites took part in the battle of Plataea[658]. In approximately the same period there appeared a new type of cuirass: made of leather with metal fittings. Information about the price of armour in the late 6th century B.C. is given by an inscription from Salamis[659]. At the same time a new type of warship, the trireme, became widespread. Its construction required not only copper nails and lead sheathing but a massive bronze ram was used as well[660]. A direct reason for these changes in military equipment may have been the defeats of Greek armies both at sea and on land by the Persians, Etruscans, and Carthaginians in 540-530-s B.C.[661]. The growing need for metals was a consequence of these changes.

The poet Hipponaxes of Ephesus was the first to mention triremes and a ram in 542 B.C. This was some years before the

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656 H. Pflug, 1988a.

657 See: P.H. Blyth, 1988, 151-153; H. Pflug, 1988b, 87.

658 See: J.B. Salmon, 1984, 165.

659 R. Meiggs, D. Lewis, 1969, N 14.

660 Ch.G. Starr, 1989, 21-25. Starr is dating the appearance of bronze rams in Greek shipbuilding early in the 7th century B.C. This date, however, was argued by H.T. Wallinga, maintaining that eighth-century ship representations clearly show the ram. See: H.T. Wallinga, 1993, 38, note 17. L. Casson (1994, 51) suggests that the invention of a ram must have taken place in the 11th-9th centuries B.C. About the evolution of ancient ram see also: E. Linder, 1991, 67-71.

661 A.M. Snodgrass, 1980, 151-154.

battle of Alalia, in which they were used for the first time, although rams may have been invented a long time before. The weight of the trireme ram is estimated at ca. 200 kg[662]. A recent find of a ram, weighing 465 kg, in a sea off the coast of Israel poses a series of problems in this connection. Some scholars consider that the ram belonged to a trireme, whereas others see it as coming from a new type of big ship built in the late 3rd century B.C. in Cyprus[663]. In any case, one can obtain an approximate idea of how much metal was needed to cast a trireme ram on the basis of the following two examples. In 526-525 B.C. Polycrates of Samos had no less than 40 triremes. In the course of less than two years before the battle of Salamis Themistocles managed to create an Athenian fleet of more than 100 triremes[664]. Thus, based on a minimal estimation of trireme rams, the Samian tyrant had to use at least 8 tons of bronze, whereas Themistocles used more than 20.

A considerable increase in Greek trade also occurred in the second half of the 6th century B.C., although, according to S.C. Humphreys, it is not clear whether this led to any significant spread of craftsmen into the cities or to greater professionalism in trade[665]. Humphreys' suggestion that the aristocracy continued to play an important role in trading activity in the Late Archaic period was criticized by C.M. Reed, who supposes that a major role in long-distance overseas trade was played by independent maritime traders[666].

Some scholars, who have analyzed the jewelry art of the 6th century B.C., have argued that there was a considerable reduction in objects dating from that period in comparison with the previous one. They come to the conclusion that gold mining ceased in this period. However, R. Higgins has mentioned that it is premature to suggest reasons for these changes until we know the sources of Greek gold in the 7th century B.C.[667]. Analysis of various kinds of sources proves that the mines of Siphnos were exploited at this time; gold was also smelted in Sardis. The difficulty lies in establishing whether gold was mined on Thasos for the greater part of the century, although precious metals were mined on the opposite

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662 J.S. Morrison, J.F. Coates, 1986, 168-169.

663 H. Frost, 1982; W.M. Murray, 1985; cf. J.S. Morrison, J.F. Coates, 1986, 168-169; W.R. Murray, 1986; E. Linder, 1991; L. Casson, 1994, 73-74, 88, 90.

664 P. Ducrey, 1986, 182-183.

665 S.C. Humphreys, 1978, 168.

666 C.M. Reed, 1984, 37-43; cf. B. Bravo, 1977; A. Mele, 1979.

667 R. Higgins, 1980, 121; M. Murray, 1983, 46.

shore of the mainland. Most of the Greek cities undertook the minting of coins, at first of electrum coins, and from the second half of the century of silver coins. Thus, there is no reason to maintain that there was a depletion of deposits of precious metals, including those of gold, at the turn of the 7th and 6th centuries B.C.[668]. In this case it would be better to follow B. Deppert-Lippitz in assuming that most precious objects have not survive, although they did in reality exist, to judge by representations of necklaces, earrings, pendants etc. on vase paintings, sculptures, and emblems on coin[669]. Some reduction in jewelry manufacture may indeed have taken place in the 6th century B.C. (see below). One should remember that practically all finds originate from the periphery of the Classical world. Therefore, it is not necessary to seek reasons for this in the sphere of metal supply. The reforms of Solon in Athens in 594-593 B.C. limited luxury, including burial expenses (Plut. Sol. 21. 2-5). The legendary Spartan law-giver, Lycurgus, who outlawed all useless arts, demanded the return of all gold and silver coins because no craftsmen working in gold and silver would stay in a land where there was no money and "their artisans were now freed from useless tasks, and displayed the beauty of their workmanship in objects of constant and necessary use" (Plut. Lycurg. 9. 1-4; 10). Greek frugality was contrasted to the Eastern desire for luxury: a symbolic expression of this contradiction is given by a debate between Solon and the Lydian king, Croesus [670].

I. Morris has recently proposed the tentative hypothesis that the 5th century was a time when display was muted all over Greece as part of a strong communal ideal. However, this "communal ideal" should have existed earlier. A good example of self-limitation is provided by Herodotus (I.82.7) who tells the story that Argive women stopped wearing gold after the Battle of the Champions, probably in the 540s B.C.[671].

Moreover, the statistics of the chronological distribution of jewelry allow us to maintain that there was no strict reduction in items of jewelry in the 6th century B.C. compared with the previous century. On the basis of a recently published work about the Greek jewelry of the 7th-6th century B.C., one can operate approximately with the following figures: ca. 260 objects are dated to the late 8th –

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[668] Cf. H.A. Cahn's remark concerning the relative rarity of silver and the diffusion of iron in the 7th century B.C. Greece. See: H.A. Cahn, 1960a, 21. See about rarity of silver in Greece in this time also G.E. Markoe, 1992, 70-71.

[669] B. Deppert-Lippitz, 1985, 115.

[670] E. Ruschenbusch, 1966, 95-97; M. Murray, 1983, 46.

[671] I. Morris, 1992, 152-153, note 23.

7th century B.C. and ca. 180 pieces belong to the 6th-early 5th century[672]. While jewelry of the 7th century B.C. originates from mainland Greece, the Greek islands and Ephesus, the majority of the 6th century objects were found in Macedonia (primarily, at the necropolis of Sindos), Thrace and the Islands[673].

Thus, it is quite probable that a reduction in the manufacture of gold objects in Greece and the drift of craftsmen to the periphery, where rich customers existed among the nobilities of Scythia, Thrace, Southern Italy, and Gaul, are best explained by such reforms, and not by shortages in Greek supplies of gold. It would be difficult to explain as a migration of the craftsmen to the sources of gold[674].

The process led to the formation of the so-called Greco-Scythian, Greco-Illyrian, Greco-Celtic, and Greco-Etruscan styles in jewelry[675]. Perhaps one of such jeweller-immigrant owned a hoard, hidden in the early 6th century B.C. on the island of Berezan. One can probably assume some reduction in the supply of precious metal to the Greek world after 546 B.C., i.e. following the conquest of the Lydian kingdom by the Persians. At any rate, this event is supposed to be one of the reasons behind the transition from electrum to silver coinage in Eastern Greece[676]. Nevertheless, the reduction in the metal supply was not a catastrophe; it led to a focussing on new sources of raw metals, for instance, in the Southern Thracian mines, which were exploited at that time by Peisistratos, and to new trade relations. I think that the conquest of the Greek cities of Ionia by Cyrus had a much stronger effect, the scale of which it is possible to imagine in the light of the latest archaeological discoveries[677]. It influenced the forced emigration of Ionian craftsmen[678], including sculptors, bronzeworkers and toreuts to other Greek centres, but also to the periphery of the Classical world, for example in the context of the "second wave" of the Greek colonization of the Northern Pontic area[679].

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672 G. Gisenhoff, 1994, 182-274.

673 G. Gisenhoff, 1994, 180; see also D. Musti et al., 1992, 38-39.

674 Cf. M. Murray, 1983, 46.

675 R. Higgins, 1980, 122; see also G. Gisenhoff, 1994, 180-181. See also C. Eluère, 1989, 55: "A traffic in gold ingots, or, more probably, in gold, across the Alps, would be a plausible explanation for the sporadic signs of Mediterranean influence in Celtic goldwork".

676 G. Shipley, 1987, 84.

677 See: M.Yu. Treister, 1990a, 168; 1990b, 42.

678 J. Boardman, 1978, 64; O. Picard, 1981, 81-82; D. Viviers, 1992, 101-102.

679 A.S. Russyaeva, 1986; M.Yu. Treister, 1990a, 168; G.A. Koshelenko, V.D. Kuznetsov, 1992, 24-25.

If one adopts the hypothesis recently put forward by W. Gauer, the conquest of the Lydian kingdom may have forced the migration of Laconian craftsmen working temporarily for Croesus to seek new markets and led to establishment of workshops in Magna Graecia, including the one in which the Vix krater was manufactured[680].

The attribution of a bronze statuette of the first quarter of the 5th century B.C. from Paestum, Ionian from a stylistical standpoint, although with a dedication in the local alphabet, allows one to infer that it may have been cast in one of the Ionian centres, whereas the inscription was cut in Paestum before the dedication of the statuette. Alternatively, and preferably, the figure was cast by a Milesian founder, who had settled in Paestum but continued to work in the Ionian tradition[681]. This interpretation fits in well with the historical context: after the conquest of Ionia by Persia in 494 B.C. Ionian craftsmen were forced to seek asylum in other regions of the oikumene.

Was there a tendency in the Archaic period to establish metallurgical installations and metalworking shops close to sources of metal and, which is also significant, to sources of fuel? The single piece of evidence, which seems to confirm this suggestion, is the find of the remains of metalworking at the Yagorlyk settlement. Nevertheless, their proximity to sources of fuel and raw metals there, according to A.S. Ostroverkhov's hypothesis, shows the seasonal character of the settlement and has to be seen in relation to the fact that they were located within the boundaries of a fairly compact city-state. If one analyses the data on copper mines and bronzeworking centres on mainland Greece in the 8th-6th centuries B.C., the following picture emerges. The highest level of development of bronzeworking in the Geometric period was characteristic of the Peloponnesian centres (Laconia, Argos, and Corinth). The only known large deposits of copper ore, actively exploited in that part of Greece from the late 19th century to 1977, are located near Ermioni in the Argolid, however the depth of the bedding and low percentage of copper give no reason to suppose that the mines were exploited in antiquity. Less important mines in the Argolid have been considered as probable sources for Bronze Age metalworking. There is no other data concerning the existence and mining of copper ores on the Peloponnese in the Geometric and Archaic epochs (see: fig. 3, 1)[682]. In spite of the existence of iron ore

680 See W. Gauer, 1991, 171-173.
681 C. Rolley, 1986a, 130, N 257.
682 See: E. Pernicka, 1987, 671.

in Laconia, which is proved by passages from ancient narrative sources and the data of archaeometallurgical studies, the quantity of iron artefacts found only became considerable after the 7th century B.C.[683]. As R.J. Forbes mentions, before the mid-6th century B.C. Laconia had barely begun the mining of iron ore in Portokalio and Kulenda at an "industrial" level[684]. Ironmaking in the area of Neapolis in South-Eastern Laconia seems to be dated from the Classical period[685].

There is also no evidence to prove that copper was mined in the Asopos valley, which could have been a source for metal for the bronze workshops of Sicyon, although there is evidence of the use of imported metal there, e.g. the "Tartessian" bronze used in casting a votive offering at Olympia and the probable interest in obtaining copper from Cyprus[686]. It is difficult to see where Corinth could have obtained metal for local metalworking. It is worth mentioning that there have been no finds of Corinthian vases of the 7th-6th centuries B.C. in Cyprus; this probably speaks against the possibility that metal was transported from the island[687].

G. Shipley's interpretation of the Giglio shipwreck is of importance. Let us assume that it was a Samian vessel, or at least a ship which had called at Samos, and was sailing from Samos to the east. If we bear in mind a passage from Herodotus, concerning the voyage of Colaeus from Samos to Iberia, such a probable coincidence of the trade route direction and the character of the cargo is not a chance one, moreover, there is a certain chronological proximity: the one voyage is only 30-40 years distant from the other. It is interesting to compare this data with the chronology of the Samian school of metalworking, which entered onto a boom period in the second half of the 7th century B.C.[688]. Besides, the dating of the protomes attached to cauldrons found in Samos proves a sharp increase in their manufacture in exactly the last quarter of the 7th century B.C. (see above on p. 129 f.). Like the bronzeworking centres of Peloponnese, whose development was fed by a supply of imported metal in the 8th century B.C., the Samian school of the sec-

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683 P. Cartledge, 1979, 90-91.

684 R.J. Forbes, 1950, 459; 1964a, 262; cf. S. Morris, 1992, 131-132 that the rich iron deposits of Laconia attracted the Phoenicians.

685 Y. Bassiakos, N.R. C.Demokritos, 1988; J.E. Bassiakos, C.T. Michael, D. Chaikalis, 1989.

686 A. Griffin, 1982, 31.

687 J.B. Salmon, 1984, 129.

688 G. Shipley, 1987, 58.

ond half of the 7th-6th centuries B.C. was also based on imported metal. Anyhow, there is no evidence either for the existence of copper mines or for their exploitation in antiquity by Samos (see: fig. 3, 1). Samian sculptors and bone-carvers used imported materials as well[689]. Although there are known deposits of lead-zinc ores on the island, some of which were mined in antiquity, the chronology of this mining activity is unknown[690]. A story is preserved about the dedication of three statuettes of sheep made of gold, silver and copper at the temple of Hera by Mandrabulos after the discovery of deposits of precious metals. This is cited by some 4th century B.C. writers and probably goes back to the same source; however the localization of these mines seems impossible[691]. Even if such a discovery was in fact made, it was made later and did not thus lead to a new boom in Samian metalworking. The establishment of the Samian bronzeworking centre was therefore a result of the development of local society in the 7th century B.C., namely the growth of an aristocracy, which probably equipped overseas trading expeditions, including those sent to search for metals, and at the same provided patrons, who attracted skilled craftsmen[692]. However the question of whether Colaeus was a representative of the Samian aristocracy is still open[693].

Euboea serves nevertheless as a controversial example. The copper mines there were actively exploited in antiquity and had already been exhausted by the time of Strabo (X.1.9)[694]. In spite of the fact that there is evidence of bronzeworking, as has been mentioned above, analysis of stylistic features of bronze objects and of their distribution by no means proves that Euboea was an important centre of bronzeworking. A similar example is Siphnos, which had not been a centre of toreutics in spite of its famous mines. Naturally, this does not mean that all the metalworking centres only used imported raw metals. For instance, analysis of Geometric tripods of the Attic type proves that they were manufactured from ore from Laurion. However, there is clearly no reason to maintain that metal workshops were sited close to sources of raw metals. Even if this sometimes occurred, it had a local character. It may have occurred more often in the case of precious metalworking. For

689 G. Shipley, 1987, 64.
690 E. Pernicka, 1987, 648.
691 E. Pernicka, 1987, 648.
692 G. Shipley, 1987, 64-65; cf. C. Rolley, 1986a, 80.
693 See: P. Herrmann, 1989, 512.
694 E. Pernicka, 1987, 671.

example, major centres for the manufacture of jewelry of the 8th-7th centuries B.C. are concentrated in Ionia or in Eastern Greece in general (Rhodes, Melos, and Ephesus) and they probably worked with metal from Lydia. This region was a pioneer in electrum coinage.

Peloponnesian centres may not have lacked sources of fuel in this period. Still in the 4th century B.C. Sicyon sent wood for the reconstruction of the Delphic sanctuary and from the time of the tyranny of Clisthenes possessed a considerable fleet; its main supplies of wood were concentrated in the mountains in the southern part of Sicyonia[695]. Corinth also very probably had sufficient resources of wood; these have been perhaps underestimated by R. Meiggs[696].

### *2.4.2. The Search for Metals and the Greek Colonization*

The reasons for and the character of the Greek colonization have been subjects of never-ending discussions[697]. During recent decades more and more attention has been paid to the quest for raw materials, primarily metals, as a motive for colonization, and the importance of the demand for metals as a reason for colonization has been considered by many scholars[698].

A. Sherratt has recently proposed a model for the Late Bronze-Early Iron Age World system and considers the development of trade routes in various areas of Europe and Asia Minor, which he defines as cores, peripheries and margins. In his opinion, the extension of urban networks into North-West Anatolia and Greece during the Bronze Age had produced indirect contacts with temperate Europe. Italy with its access to the Alps, which are an important source of metals, thus came to be an interface between the maritime trade networks of the Mediterranean and the overland links of continental Europe, in a way that Greece could not. In the early centuries of the first millennium the Phoenicians penetrated into

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695 A. Griffin, 1982, 30-31.

696 R. Meiggs, 1982, 130; cf. J.B. Salmon, 1984, 123; R.S. Stroud, 1985, 697.

697 See, e.g., the publications of the last decades: M.M. Austin, P. Vidal-Naquet, 1977, 61 ff.; L.H. Jeffery, 1978, 51 f.; O. Murray, 1980, 102 ff.; *The Expansion of the Greek World*, 1982; V.P. Yajlenko, 1982, 4-60; A.J. Graham, 1983; F.V. Shelov-Kovedyayev, 1985, 44-57; G.L. Cawkwell, 1992; G.R. Tsetskhladze, 1994a.

698 C. Roebuck, 1959, 87-104; M.I. Finley, 1970, 97; A.J. Graham, 1971, 35-47; Ch.G. Starr, 1977, 62 f.; J. Boardman, 1980, 162, 208; J. Fine, 1983, 81; B. Cunliffe, 1988, 12-37.

Sardinia and the Western Mediterranean, and they and the Greeks tapped into the resources of the Tyrrhenian world. By 750 B.C. these contacts (through trading stations like Pithekoussai) were initiating fundamental transformations in the cultures of the Italian peninsula. This area, at the interface of land and sea routes, became a primary node of contact between the maritime and overland systems of transport. One of the commodities obtained by Greeks in Etruria was iron—from the rich deposits of Elba—and an iron industry developed on a large scale in response to "international" demand. In the societies of the Alpine periphery the conditions obtained for both the intensified extraction and the transport of local products, mostly raw materials, seen primarily in the development of mining and the production of salt. In Sherratt's view, the changes which occurred in the 6th century B.C. with Hallstatt D were the result of a further intensification of competition in the Central and Western Mediterranean, as the Greeks extended their direct contacts to the head of the Adriatic (Spina) and to the mouth of the Rhône (Massalia), while the Etruscans held sway over the semi-periphery of the Po basin and intensified their links across the Alps. A new supply network up the Rhône may have captured some of the Central European metal supplies (especially tin) which had previously moved down the east Alpine route. Two other parts of Southern Europe developed as peripheries on nodal interfaces between the Mediterranean maritime trade and the European routes. In Spain, Phoenician colonies stimulated the formation an indigenous urban core (similar to that of Etruria), namely the kingdom of Tartessos, which acted as the terminus of the long Atlantic routes. On the Black Sea, the Greek colonies first founded on the mouth of the Danube (Histria) tapped the metals, salt, and livestock of Wallachia and Transylvania[699].

We should now discuss colonization in the 8th-6th centuries B.C. in nine different regions of the ancient world: 1) the areas colonized by the Phocaeans in the Western Mediterranean (Gaul, Iberia); 2) Pithekoussai and areas of Euboean colonization in the West; 3) Illyria and areas of Corinthian colonization; 4) Thasos and the colonization of the island by the Parians; 5) the Ionian colonization of the Western Black Sea littoral; 6) the colonization of the Northern Pontic coast; 7) the colonization of Colchis; 8) the colonization of the Southern Pontic region; 9) early Greek colonies in the Near East.

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[699] A. Sherratt, 1993, 39-42; E.S. and A.G. Sherratt, 1993.

It has been more than once maintained that one of the reasons for Greek colonization in the West was the search for metals, primarily for silver and tin, in which Iberia is very rich[700]. This view was put forward most recently by H.T. Wallinga, who noted that the long-distance colonizing ventures of the Phocaeans that had lasting effect were all directed to metal-bearing regions: Massalia at the end of the tin-route running from Armorica and Southern England; Alalia near to the Etruscan iron (and other metal?) deposits; Amisus as a station on the road to the Chalybes; and Emporion near the northern Spanish mining areas. This distribution of Phocaean *emporia* strongly suggests that their founders were specialists in the metal trade, and this again implies that they also came to Tartessos primarily to procure metals[701].

Scholars have unanimously held that the few early Greek articles (Attic and Corinthian pottery of the late 8th—early 7th century B.C.) found in thge southern part of the Iberian peninsula were brought there by the Phoenicians[702]. It is thought that the first information about Tartessos was brought to Greece by the Phoenicians; in this connection great importance attaches to the passage from Diodorus (V. 35.3) where he says that the Phoenicians brought Spanish silver to Greece, Asia and to other peoples.

One is also reminded of the passage in Strabo (III.5.11), although the date of reference is uncertain (probably from the 7th to the 4th century B.C. as P. Rouillard has suggested[703]) about the Artabrians, leaving on the Cassiterides: "As they have mines of tin and lead, they give these metals and the hides from their cattle to the sea-traders in exchange for pottery, salt and copper utensils. Now in former times it was the Phoenicians alone who carried on this commerce (that is, from Gades), for they kept the voyage hidden from every one else" (transl. by H.L. Jones).

A new wave of imports, primarily from East Greece, began in the late 7th century B.C. Some scholars (for example, B. Shefton, Yu.B. Tsyrkin, and P. Barceló)[704] put this down to Phocaean activity, while others think that Greek goods were carried by the Phoeni-

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[700] M. Cary, 1932, 136-138; C. Roebuck, 1959, 94, 99; L.H. Jeffery, 1978, 227; O. Murray, 1980, 106. At present that point of view is prevailing: see, e.g.: J.-P. Morel, 1982, 495 ff.

[701] H.T. Wallinga, 1993, 70.

[702] See, e.g.: B. Shefton, 1982, 338 f.; Yu.B. Tsyrkin, 1984, 41; R.J. Harrison, 1988, 77-78.

[703] P. Rouillard, 1991, 205.

[704] See,e.g. P. Barceló, 1988, 122-123.

cians (J.-P. Morel, X. Alvar, and P. Rouillard)[705]. The latter point of view is close to J. Hasebroek's idea that the entire overseas trade of the Homeric period was concentrated in the hands of the Phoenicians[706]. As A.J. Graham has stated, nothing from the pre-colonial material points to Phocaea; any combination of the Etruscans, Phoenicians, or Greeks could have been carriers of pre-colonial goods[707].

Yu.B. Tsyrkin considers that the Phocaeans not only maintained relations with Tartessos, but also had settlements on Tartessian territory, but admits that contacts were insignificant; these were interrupted by political events at the turn of the 6th/5th centuries B.C., namely the disintegration of the Tartessian state and the seizure of what remained by Carthage. In the opinion of some scholars, direct Greco-Tartessian contacts had been conducted since the second half of the 7th century B.C., whereas in the first half of the 6th century B.C. a Phocaean colony, Mainake, was founded on the territory of the Tartessid.

P. Barceló maintains that in Huelva there is much evidence of the presence of small groups of Greeks, evidently merchants or craftsmen in Tartessian settlements. Barceló considers that these Greek agents had most probably come to the local settlements with the mission of establishing and promoting direct trade with their mother-cities, especially in the supply in raw metals[708].

One should however note that H.-G. Niemeyer supposed that the remains of Toscanos in the south of Iberia are to be identified with the ancient Mainake mentioned by Classical writers, which was not in reality a Phocaean colony and was abandoned from the mid-6th century B.C. to the Early Imperial period. Moreover, W. Röllig and B. Treuman assumed a Semitic root in the name Mainake[709]. Phoenician influence on the ironworking of Toscanos is beyond question[710]. And the following detail is very significant: in the exca-

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[705] See,e.g. P. Rouillard, 1991, 204.

[706] See the critics: C.M. Reed, 1984, 32-36, note 38.

[707] A.J. Graham, 1990, 59-60.

[708] P. Barceló, 1988, 122-123.

[709] H.-G. Niemeyer, 1980, 165 ff.; 1982, 369 f.; 1992, 276-278; A.M. Snodgrass, 1987, 58-59; P. Barceló, 1988, 32; S. Morris, 1992, 205-206. See, however, P. Rouillard, 1991, 292-297: survey of literary sources and hypotheses about the localisation of Mainake. He came to the conclusion, that even if the existence of Mainake will be proved, its location still remains unknown.

[710] For instance, iron slag from Toscanos and Moro de Mezquitilla represents the earliest for Western and Southern Europe examples of reduction technology. See: F. Goldschani et al., 1988.

vations at Toscanos numerous finds were made of fragmentary and intact nozzles of bellows with two openings comparable to those from the settlement of Serro Salomon in Huelva, from Carthage and from the 7th century B.C. layer at Lacco Ameno on Ischia[711]. According to H.-G. Niemeyer, the Phoenician settlements of the Toscanos type cannot, given their streetplan, be identified with the Greek colonies in the West; they were settlements of a special sort, which may be described as trading stations or trading settlements. They appear to constitute a different 'model', one which is reminiscent of K. Polanyi's 'port of trade', an institution of professional trade situated in geographical and structural terms on the border between a non-market-oriented society and a market economy. An important characteristic of this institution is its independence from both the hinterland and the business leaders of the mercantile system, so that it forms a sort of buffer zone[712].

An evident weakness in theories supporting direct Greco-Tartessian contacts lies in the following. Some scholars, like Yu.B. Tsyrkin, do not exclude the possibility that Greek goods of the 6th century B.C. were brought to Tartessian territory by the Phoenicians; among the objects given by the Greeks directly to the Tartessians were a small Phocaean electrum coin of the first half of the 6th century B.C. and a bronze ring with a Greek inscription[713]. While I accept Tsyrkin's thoroughly understandable caution, I cannot help but putting the question: what did the Phocaeans give in exchange for such numerous cargoes of ingots?

The concentration of Greek pottery of the 6th century B.C. in settlements of the province of Huelva is usually explained in terms of trade in its ore resources[714]. However, even in comparison to other regions of Iberia the concentration of Greek pottery in Huelva is overwhelmingly significant. If one looks at Greek pottery dated from ca. 800 to 325 B.C. and found in Huelva, only 10.5% of it belongs to the 6th century B.C., compared to only 2.2% (P. Rouillard, 1991) or 2.3% (H.-G. Niemeyer, 1992) of contemporary Greek pot-

[711] H.-G. Niemeyer, 1983.

[712] H.-G. Niemeyer, 1989, 29-31; 1990, 485; 1992, 279; cf. P. Rouillard, 1991, 307-313.

[713] Ju.B. Tsyrkin, 1984, 49; see also: A.E. Furtwängler, 1977, H.-G. Niemeyer, 1992, 285. P. Rouillard has compiled a list of bronzes, Greek, Etruscan and South Italian found in the Iberian peninsula. Among the 17 objects dated before 400 B.C. there are 4 Greek, 2 Etruscan and 1 South Italian bronzes of the 6th century. See: P. Rouillard, 1991, 187-189.

[714] B. Shefton, 1989, 209ff.

tery finds in the Iberian peninsula on the whole. These figures are especially modest in comparison to finds of the 4th century B.C. (82.6% of the finds in Huelva, and 72.2% finds in the Iberian peninsula)[715].

H.T. Wallinga has recently stated in this connection that goods are not the only exchange objects to be considered. Services also do not show in the archaeological record, but that is no reason to ignore them. Thus, Wallinga assumes that the Phocaeans combined trade and service as mercenaries with the Tartessian kings, and in this sense he interprets Arganthonios' invitation to the Phocaeans to settle in Tartessos as well as a story about the Samian Colaeus preserved by Herodotus. The combination of soldiering and trade was likely to have brought more men to Spain than trade alone[716].

H.-G. Niemeyer has put forward the idea that Phocaeans and Phoenicians peacefully coexisted: "Müssen wir nach allem also nicht davon ausgehen, dass gerade in der früharchaischen Zeit der Handel auf dem Mittelmeer eine gemeinsame Sache der Seefahrer und Handelsleute war?"[717]. The same view is taken by S. Morris, who states however that the original commercial and industrial initiative belonged to the Phoenicians[718].

How can we correlate the data of narrative and archaeological sources with the results of archaeometallurgical studies? Copper and silver mines were exploited in the south of the Iberian peninsula in the 8th-6th centuries B.C. and the metal from these was probably acquired by the Phoenicians. Were the Greeks interested in obtaining these metals? In any case, as Herodotus mentions (IV. 152), Colaeus of Samos brought a consignment of silver in ca. 638 B.C. However, the voyage is dated to the pre-colonial period and was, most probably, an unusual occurrence; the colonies founded by the Greeks in the West could hardly have resulted from the voyage of Colaeus.

The recently suggested hypothesis that silver from the Huelva mines was obtained via Tartessos by the Greeks and that this aided the accumulation of large stocks of silver in Greece necessary to begin minting coins[719], does not take into consideration the fact that early Greek coinage was based not on silver but on electrum

[715] P. Rouillard, 1991, 107-117; H.-G. Niemeyer, 1992, 281-284, Tab. 2-3.
[716] H.T. Wallinga, 1993, 71-72.
[717] H.-G. Niemeyer, 1990, 487-488; 1992, 292-295.
[718] S. Morris, 1992, 210.
[719] J.G. Chamorro, 1987, 202.

which may have originated in Asia Minor (see above on p. 131 f.). It is thought that silver was taken to Greece from Iberia only prior to the mid-6th century B.C., because after the battle of Alalia in ca. 540 B.C. the Carthaginians and Etruscans had practically closed the Western Mediterranean to Greek trade[720]. One should note that this event was not reflected in the volume of Greek coinage, whereas the sharp increase in silver coinage in Athens, Corinth, and Aegina took place not long before this, in ca. 560 B.C. The results of lead isotope analysis of silver coins of the mid-6th – early 5th centuries B.C. from the Asyut hoard have brought no unexpected conclusions. Only three out of 112 coins could have been coined from metal, which had perhaps originated from the mines of Los Linares or Rio Tinto[721]. It would be extremely valuable to analyze materials of the second quarter of the 6th century B.C. to decide whether silver was exported from Iberia to Greece. The hypothesis put forward by some scholars about the use of Iberian silver in the coinage of Himera and Selinus in Sicily[722] should also be analytically checked. There is no explanation of how silver from Spain was further distributed, whereas it is assumed that most Greek cities were supplied by Corinth. The fact that after 540 B.C. the coinage of Himera remained abundant is explained by T. Dunbabin by the fact that silver could have been brought to Greece by the Carthaginians[723]. There is a widely held opinion that the Phocaeans brought tin from Iberia to Ionia[724]. It is supposed that Greeks before Pytheus never sailed to the "Tin Islands", but they exchanged tin in Tartessos for craft and agricultural products[725]. There is also a view that the Phocaeans founded their colony at Massalia to obtain direct access to Atlantic sources of tin[726]. Many scholars consider it probable that tin was traded via the rivers Seine, Rhône and Saône. This "tin route" existed as long ago as in the Bronze Age[727]. Etruscan goods were also imported into Gaul by this route[728]. Yu.B. Tsyrkin considers that tin was brought to Massalia via the Rhodano-Sequanean or Rhodano-Rhinean routes in the 6th century B.C.[729].

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[720] M. Cary, 1932, 137; N.H. Gale et al. 1980, 12, 43.
[721] N.H. Gale et al., 1980, 43, 46-49.
[722] See: J.G. Chamorro, 1987, 203, note 33.
[723] T. Dunbabin, 1948, 248, 301; see also: C.M. Kraay, 1984, 14.
[724] C. Roebuck, 1959, 94-100; D. Muhly, 1973, 270; 1985, 276.
[725] D. Muhly, 1973, 270.
[726] See the survey of various points of view: F. Villard, 1960, 143-161.
[727] J.J. Jully, 1968, 55 suiv.
[728] See: S. Boucher, 1970; 1976, 15-17, 347, fig. 1; J.-P. Morel, 1981, 489 suiv., 464, fig. 1; B. Cunliffe, 1988, 24-32.
[729] Yu.B. Tsirkin, 1968.

However, tin was never the sole item of trade, and probably, as P.C. Wells assumes, not even the main one: trade in tin cannot explain the presence of, first, Etruscan, and then Greek imports in such a broad area of Gaul[730]. A similar conclusion can be reached on the basis of data published by M. Gras, B. Bouloumié, and C. Rolley. According to the statistics of B. Bouloumié, 192 articles of Etruscan manufacture are opposed to only 12 of Greek. Among 34 vessels, dating to 650-575 B.C., 32, or 95%, are Etruscan. Massaliot imports, including amphoras, and Attic red-figured pottery, had penetrated into Gaul from ca. 525 B.C. This period of contact with Massalia did not last. Thus, all 150 vessels dating to 490-400 B.C. are of Etruscan manufacture. The nature of these contacts, as B. Bouloumié supposes, gives reason to think that Etruscan imports (wine and bronze ware) were diplomatic gifts or presents but not items of trade[731]. Although the attributions made by B. Bouloumié are not indisputable[732], the leading role of Massalia as an intermediary in the tin trade should be questioned.

The idea has also been put forward that a trade route, crossing France and Switzerland over the Alps to the Adriatic ports of Adria and Spina, remained in use after the Greeks had lost their supremacy at sea following the battle of Alalia; this is proved by the dates of settlements with Greek imports, which were founded in ca. 540 B.C. and abandoned in ca. 480 B.C., practically simultaneously[733].

Some scholars considered it to be the most important tin route by which the Mediterranean was supplied[734]. However, there are arguments that this overland trade route was not a tin route, because tin was only one of a number of goods which may had been transported over this route and may have perhaps also included iron from the mines of the Alpine region[735].

The question of the origin of the tin, which was transported from North Western Europe to the Aegean basin, has not yet been finally

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[730] P.C. Wells, 1979, 21; see also: *The Expansion of the Greek World*, 1982, 141; A.J. Graham, 1984, 6; 1990, 58.

[731] B. Bouloumié, 1985, 167-178; cf. C. Rolley, 1988b; I. Wernicke, 1991, 64-65; A.-M. Adam, 1993.

[732] Cf. C. Rolley, 1982, 101-102; 1987, 345-349; J.-P. Morel, 1981, 498; J. Bouzek, V. Kästner, 1988, 387, 389.

[733] H. Schwab, 1983, 405 ff. However, recently published 11th-10th centuries B.C. tin decorations found in Switzerland may had been done from the metal coming from Toscana. See: M. Primas, 1984.

[734] R.L. Beuamont, 1936, 190.

[735] P. Kracht, 1991, 139-143.

solved, although many scholars suppose that in the period discussed tin was exploited in Cornwall, where it was extracted as long ago as in the early 2nd millennium B.C.[736]. At the same time, remains of mining from the period discussed are unknown in Cornwall. According to J.P. Northover, in the 8th-6th centuries B.C. Brittany was the main producer of tin, while tin from Cornwall was imported to the mainland only after the 3rd century B.C.[737]. This hypothesis is proved by studies of trade relations between the British Isles and the continent in the Late Bronze and Early Iron Ages[738]. J. Ramin, who has dedicated a special study to the problem of tin sources, also considers that the mines of Cornwall and Iberia should be excluded. He identifies the Cassiterides with the islands in the estuaries of the Loire and the Cyberone[739]. Ancient mines in the province of Poitou are known on the Loire estuary. Archaeological data shows that they were exploited from the Late Bronze Age till the Roman era. The average tin content of the bronze ingots dated to the Bronze Age, and found in this province, is 10%[740]. Average tin concentrations in Late Bronze Age objects found in a hoard in the province of Deux-Sevre are 11.2%, while in Hallstatt bronzes from Picardy these are ca. 12.5%[741]. At the same time, axes in Late Bronze Age Brittany were usually cast of lead-tin bronze with an average tin concentration of ca. 6.1 %[742].

Until recently the earliest known tin ingots found in Greece or Asia Minor were dated to the Roman period. In 1983-84 near the southern coast of Turkey, not far from Kaş to the west of Cape Gelidonya, the remains were discovered of a 14th-century B.C. shipwreck with 84 copper and tin ingots[743]. Finds of tin ingots bearing symbols from the Cypro-Minoan syllabic alphabet of the 16th-11th centuries B.C. were taken from the sea off the port of Haifa[744]. All these ingots originate, most probably, from the same

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[736] D. Muhly, 1973, 270; 1985, 287-290; *IAMS Newsletter* 4 (1983), 1. The recent hypothesis about the ancient tin mining in Sardinia should be approved. See, e.g.: F. Lo Schiavo et al., 1985, 318.

[737] Personal communication in the letter dated 28.VII.1985. About the British tin trade see also: C.F.C. Hawkes, 1984; cf. N. Ehrhardt, 1990, 26, Anm. 142.

[738] B. O'Connor, 1980, 300.

[739] J. Ramin, 1965, 103-113.

[740] J.-P. Patreau, 1984, 101, 125-127, fig. 1.

[741] J. Bourhis, J.-P. Patreau, 1984, 42, 137.

[742] J. Briard, J. Bourhis, 1984, 59.

[743] C. Pulak, D.A. Frey, 1985; R.D. Penhallurick, 1986, 105; C. Roden, 1989, 125; G.F. Bass, 1990; A.J. Parker, 1992, N 1193 with references (ca. 1325 B.C.).

[744] R. Maddin et al., 1977, 45-47; D. Muhly, 1978; *IAMS Newsletter* 1 (1980), 1; 2 (1981), 4; R.D. Pennhallurick, 1986, 106.

shipwreck. As B. Rothenberg has stated, the so-called "Cypro-Minoan signs", engraved on the ingots, were common not only in the 2nd millennium B.C., but also later on, up to the 7th-6th centuries B.C., in Iberia. According to a preliminary suggestion, both the copper and tin ingots found in Haifa bay, were loaded onto a ship in Spain in ca. 700-600 B.C. B. Rothenberg and A. Blanco-Freijero consider that the tin ingots may have been transported by sea from Tartessos, and maintain that the tin traded by the Tartessians originated not from South-Western Iberia but from the rich tin-bearing North Atlantic area[745]. At the same time, publication of preliminary studies of the ingots in the British Museum Research Laboratory have given ground to suppose that the tin was probably of Iberian origin, whereas the copper came from Cyprus or Anatolia. It was expected that lead isotope analyses in Oxford would clarify the picture[746], although it was impossible to make such analyses, because of the absence of lead admixtures in the metal of the ingots[747].

The answer to the question of the relation between colonization and the search for tin is very complex. If one analyses the statistically arranged data of the results of metal analyses of Greek bronze objects from the Bronze Age to the Classical period, there are no sharp leaps in the tin content of items of the 8th-6th centuries. I have generalized the results of analyses made by the British Museum Research Laboratory[748]. Certainly, the results used there are not completely correct, because various categories of objects represent different periods and the numbers of analyses are not evenly distributed according chronological periods. Moreover, P.T. Craddock published the results of metal analyses without differentiating the regions in which the objects were found. The statistically arranged data used there thus shows a more or less "average" picture of the dynamics of Greek bronzeworking.

In Late Bronze Age objects (22 analyses, statuettes) the tin concentration varies between 5.6 and 15.8%, and is 7.4% on average[749]. Approximately the same tin admixtures were typical of Greek Geometric bronzes (160 analyses, statuettes and decorative bronzes). A

[745] B. Rothenberg, A. Blanko-Freijero, 1981, 182, note 211, cf. C. Roden, 1989, 125.

[746] *IAMS Newsletter* 2 (1981), 4; E. Galili, 1987, 5.

[747] Perconal communication of B. Rothenberg in the letter dated 20.01.1986.

[748] P.T. Craddock, 1976; 1977.

[749] I consider the border of artificial alloying the concentration of 1%. See: M.Yu. Treister, 1983.

certain increase in tin alloying took place in the Archaic period. The average tin content reached ca.8.0%, and was 7.4% in the metal of statuettes, 8.9% in decorative bronzes, 9.9% in mirrors, and 8.5% in vessels (105 analyses in total). Admixtures of tin reached an average of 8.5% in Classical bronzes (statuettes, mirrors, and vessels, 86 analyses in all).

More informative are the results of analyses of Greek, Near Eastern and Orientalizing bronzes carried out in the course of studies by C. Rolley and Greek scholars. They analyzed bronze tripods of four types, dating from the late 9th to the second half of the 8th century B.C. (fig. 25). Only in 11 out of 20 tripods, dating to the late 9th – mid-8th centuries B.C., was the presence attested of more than 1% of tin, which allows one to assume some artificial alloying, while the average tin content is ca. 2.8%. The situation changed in the second half of the 8th century B.C. In 13 out of 16 cases analyses show the presence of tin admixtures of more than 1%; the average tin concentration increased to 4.5%. Thus, in contrast to the period of the late 9th-first half of the 8th centuries B.C. the use of tin for alloying in Greek bronze tripods increased in the second half of the 8th century B.C. by 60%. In similar types of Greek and Orientalizing bronzes and cauldrons with griffin protomes the average tin concentrations were correspondingly higher—8.45% and 8.87%[750]. In one publication on the metal composition of Orientalizing bronzes, including those of griffin protomes, an extremely high tin content (10-40%) was given[751], however, P.T. Craddock considers the results to be unreliable because of an incorrect methodology for determining tin[752].

By comparison one should note that analyses of bronze objects from excavations of Early Iron Age Tejada in Iberia have shown that these include an average of ca. 7% of tin, while in Late Bronze Age items tin concentrations in alloys were higher, ca. 9%. Thus, from the standpoint of tin concentrations, the Iberian bronzes correspond well to chronologically similar materials from Sardinia, Italy (including Etruria), Greece, and Nimrud[753]. The statistics of the results of 169 analyses of Etruscan bronzes of the 7th-6th century B.C. show that they contain on average 7.85% of tin (including

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[750] C. Rolley et al., 1983, 118, 131; E.A. Sanpaolo, 1990, 119, fig. 45.

[751] L. Vlad Borelli et al., 1979.

[752] Perconal communication in the letter dated to 23.05.1983.

[753] P.T. Craddock, 1980, 61 f.; 1981, 279; A. Giumlia-Mair, 1988; 1992; P.T. Craddock, A. Giumlia-Mair, 1988, 319.

7.5% in decorative bronzes, 8.25% in statuettes, and 7.45% in vessels)[754].

Thus, Archaic Greek bronzeworkers used approximately the same proportions of tin as their colleagues in Etruria or in Iberia. Analyses confirm a certain increase in tin concentrations for bronze alloying in the Archaic epoch in contrast to the previous period. In some categories of Greek bronzes, such as tripods, the considerable increase in tin concentrations is datable to the second half of the 8th century B.C., i.e. to the early period of colonization in the West.

According to C. Rolley and his Greek colleagues, the problem with tin alloying is quite clear. Eastern bronzesmiths already employed alloying of bronzes with high proportions of tin before the mid-8th century B.C., this in contrast to Greek craftsmen. Without giving an answer to the problem of the sources of tin, they raise the question of the "export of technology". They consider that the period discussed saw not only the adoption of Eastern forms and motifs by Greek craftsmen, but that bronzeworkers and jewellers from Northern Syria and Phoenicia, who kept their contacts with their homelands, were working in Greece[755].

Even before the foundation of Al Mina, Phoenican traders were active in the Aegean, probably attracted by its metal resources[756]. Oriental goods were supplied to Lefkandi in Euboea already in the 10th century B.C. It has been maintained that gold was also provided in some quantity, sometimes as finished artifacts, sometimes

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754 P.T. Craddock, 1984.

755 C. Rolley et al., 1983, 127, 130; E. Magou at al., 1986; 1991; C. Rolley, 1984, 178; 1984a. Cf. O.W. Muscarella, 1992, 39.

The hypothesis, that metalworkers originated from the East were constantly living in the Aegean was put forward first by T. Dunbabin (1957); shared by D. Coldstream (1977, 365-366; 1982, 268, 272). See above also the point of views expressed by J.Boardman, R. Laffineur, R. Higgins, B. Deppert-Lippitz; V.P. Yajlenko, 1990, 133-134, 212-215. See about the development of Western Asia metalworking centres: P.R.S. Moorey, 1988; J.E. Curtis, 1988; I.J. Winter, 1988.

756 J.N. Coldstream, 1982, 265; G. Falsone, 1988, 239-240; W. Culican, 1991, 478-479; I. Strøm, 1992a, 46-60; P.M. Bikai, 1992; S. Morris, 1992, 124-149; M.-E. Aubet, 1993, 102 ff.; archaeological evidence for the activities of the Phoenicians in Cyprus from the 9th century B.C. is extensive, see, e.g., I. Michaelidou-Nicolaou, 1987; A.M. Bisi, 1987.

S.Morris, e.g., maintains that importance of the mineral sources of the Aegean was a chief catalyst for Levantine contact with Greeks. She thinks that critical to the Phoenicians and to their customers, the Assyrians, were the iron ores plentiful in Western Crete, Laconia, Euboea and Thasos. As in Sicily, Iberia and Cilicia, Phoenician settlements or trading posts were also located on shipping routes where access to resources could be organized with local cooperation (see S. Morris, 1992, 131-132).

as a raw material to be worked locally following the instructions of Phoenician jewellers[757].

The evidence for resident Phoenician craftsmen in Greece is especially strong for Kos, Rhodes, Crete and, perhaps, Ephesus[758]. "The later Geometric jewellery of Greece still preserves a strong Phoenician character, strong enough to suggest the residence of a few master jewellers from the Eastern Mediterranean, especially in Attica and Crete"[759]. In the so-called "Tomb of a Rich Athenian Lady", of ca. 850 B.C. on the northwest slope of Areopagus, a pair of gold earrings was found of local design. These however were made using the Syrian/Phoenician techniques of filigree and granulation, and were apparently the work of a Near Eastern goldsmith working in Athens[760]. G. Kopcke even suggests that this first-rate Phoenician craftsman was brought by the Phoenicians "as part of a deal, answering their partner's wishes. But even if the pendants were fashioned in the East for Greeks, it would remain true that those who brought them were exceptionally well connected at both ends of their venture"[761]. It was recently suggested by J.N. Coldstream that the Phoenician goldsmith buried in the mid-9th century tomb at Tekke on Crete[762] had some special connection—most probably through marriage—to the local aristocracy, and that his "apprentices" were in fact "his sons and grandsons, who learned from him, and passed on, the skilled techniques of granulation, filigree and inlay; but being themselves the offsprings of mixed marriages, only very gradually—as J. Boardman has shown—did they adapt their style and iconography to local taste"[763]. We should also consider the view of J. Boardman that immigrant goldsmiths in Crete, Attica and Euboea were working in styles which are better matched in North Syria than in Phoenicia[764]. E. Akurgal suggests that the hammered griffin protomes decorating cauldrons, dating from the end of the 8th century B.C. to ca. 680 B.C. and even the earlier examples of cast protomes, were produced in Greece by oriental toreuts who had

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757 J.N. Coldstream, 1982, 266.

758 J.N. Coldstream, 1982, 268-269; A. Bammer, 1985; G. Kopcke, 1992, 108, note 24 with references; J.N. Coldstream, 1993, 99.

759 J.N. Coldstream, 1982, 266.

760 R. Higgins, 1980, 97; B. Deppert-Lippitz, 1985, 58-59; G. Markoe, 1985, 118, note 146; I. Strøm, 1992a, 47.

761 G. Kopcke, 1992, 106.

762 See: J. Boardman 1967; R. Higgins, 1980, 107-108; B. Deppert-Lippitz, 1985, 66-68.

763 J.N. Coldstream, 1993, 99-100.

764 J. Boardman, 1990, 179.

been invited to work at Greek workshops to fulfil the orders of Greek customers[765].

Although this hypothesis about the work of Near Eastern craftsmen in Greece is not accepted in all details by all scholars[766], there seems to be a clear change in the sources of raw materials or in technology, or, perhaps in both, at the junction of the Geometric and Orientalizing periods[767].

The Sidonian craftsman, who produced the large silver vessel awarded to Achilles, was called *polydaidaloi* in the Iliad (XIII, 740-749). The earliest example of a North Syrian metal object, found in Greece, is a bronze bowl from a burial at Kerameikos, which is dated to ca. 840-830 B.C.[768]. In ca. 900 B.C. a bronze bowl of Syrian or Phoenician manufacture was brought to Lefkandi in Euboea[769]. I.J. Winter supposes that articles of Northern Syrian manufacture reached Greece as trade items, as a war booty, and as gifts and tribute, and added to the supply of raw metal[770]. A high standard of metalworking was achieved in Urartu and Assyria, not only in the sphere of small bronzes: for example, the colossal bronze lions installed at the palace of Sennacherib at Nineveh had a weight of 11400 talents, or 42 tons each[771]. Details of the organization of Early Iron Age metal workshops are unknown, nevertheless, judging by the tribute lists of Northern Syrian rulers in the Neo-Assyrian period, it is clear that the state played an important role in the acquisition and distribution of metals. Perhaps, the level of control

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765 E. Akurgal, 1992, 40: "Die Hersteller waren aus dem Orient eingeladene orientalische Toreuten, die im Aufträge ihrer griechischen Arbeitgeber in den griechischen Werkstätten als Gastkünstler tätig waren und diese damals in Griechenland sehr *à la mode* gewordenen Kunstwerke produzierten". See also: E. Akurgal, 1992, 41-42.

766 See, e.g., a recent opinion of J. Boardman, that the supposed Eastern settlers in Greece were not traders but craftsmen, having mainly North Syrian connections, although they are detected by the products of their craft, unaccompanied by any evidence for settlements, having sustained links with their homeland. The author supposes that eastern connections were provided by Greek traders via Al Mina. See: J. Boardman, 1990, 182, 186; cf.: J.D. Muhly, 1988, 337-339; O.W. Muscarella, 1992, 44-45. I. Strøm (1992a, 47), for instance, supports the idea that from ca. 700 B.C. we no longer have the impression of resident foreign craftsmen in Greece, but rather of an organized Greek import conducted by a group of sanctuaries. Cf. the view of E. Akurgal on the manufacturers of hammered griffin protomes, dating to the late 8th-ca. 680 B.C. (E. Akurgal, 1992, 40-42).

767 J.D. Muhly, 1988, 339.

768 I.J. Winter, 1988, 207-208.

769 G. Falsone, 1988, 238.

770 I.J. Winter, 1988, 212.

771 J.E. Curtis, 1988, 92.

of production was different between items in precious metals and items in bronze[772]. Greek metalworking followed a course beginning with the adoption Eastern prototypes to the creative interpretation of types, shapes and decorations, which led to the formation of a Greek Orientalizing style. The extent of Eastern influence on the formation of Greek metalworking has been given different evaluations[773].

A casting mould from Al Mina in the Ashmolean Museum is significant both for ethnic attribution of its makers and, in historical terms, for an evaluation of the role of Greeks and local populations in the early economy of the site. The closest comparanda to one of motifs carved in the mould, a crescent-shaped pendant from the Kameiros necropolis found in a grave dated to about 700 B.C.[774], probably points to the second half of the 8th-early 7th century B.C. as the most plausible date for the mould from Al Mina. The majority of the parallels allows us to suggest that it was most likely to have been used for casting objects in gold and silver, rather than in bronze. The subjects engraved in the mould find close parallels among Near Eastern moulds which originate from Zinčirli or its vicinity and date to the 8th-7th century B.C.[775], from Eanna[776] and from Ras Shamra[777]. However, the most striking parallel is the completely preserved fold of a mould of grey-green serpentine found during excavations of the lower Western Palace at Zinčirli, which is dated by the context of the find to between the mid-8th and the early 7th century B.C.[778].

The mould from Al Mina supports the view that fairly soon after the foundation of the settlement (various opinions have been put forward regarding the absolute dating of the foundation of Al Mina[779], i.e. from the second half of the 8th to the early 7th century

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[772] I.J. Winter, 1988, 205.

[773] J.N. Coldstream, 1977, 358 f.; cf. V.P. Yajlenko, 1990, 214-215.

[774] See about the mould from Al Mina: M. Yu. Treister, 1995; cf. the mould from Kameiros: A. Greifenhagen, 1970, 27, Taf. 27, 5.

[775] F. von Luschan, 1943, 24, Abb. 16b; R.-B. Wartke, 1980, 238, N 24, Abb. 26; 250.

[776] R.-B. Wartke, 1980, 241, N 30, Abb. 32.

[777] J.-C. Courtois, 1973, 292-293, fig. 4.

[778] F. von Luschan, 1943, 23, 146, Taf. 8a; R.-B. Wartke, 1980, 235-236, N 19, Abb. 21.

[779] So, C.L. Woolley (1938, 16 ff.) dated the earliest Strata X-IX to 750-700 B.C.; J. Boardman (1965, 12; 1980, 43-44) assigns the earliest strata to 850-800 B.C.; E. Gjerstad (1974, 121-122) to 750-690 B.C.; D. Ridgway (1992, 24) considers the foundation date to be ca. 825 B.C., as it was earlier suggested by J. du Plat Taylor (1959, 62ff.).

B.C.) a North Syrian jeweller, most probably from Sam'al (modern Zinčirli) in Northern Syria, was working there. The motifs on the casting mould from Al Mina have many Phoenician parallels. This fact may be explained by the marked Phoenician influence in Zinčirli[780]. Naturally, the isolated find of a casting mould at Al Mina cannot of itself form a basis for solid conclusions, but in conjunction with other North Syrian materials from the site, and in contrast to the clearly Greek character of casting moulds from early Greek colonies, it supports the following statements:—Greek and Syrian populations lived there together, the Greek element represented mainly by merchants, while the infrastructure of the settlement was local, including native craftsmen (cf. the picture drawn by D. Ridgway: "A few enterprising merchants from Euboea and the Cyclades must have taken up residence at Al Mina right from the beginning, although there is no reason to believe that they amounted to more than a small group (certainly not a colony) within an essentially non-Greek population)"[781];—the idea of the stable influx of North Syrian material into Greek areas in the 8th century B.C. via Al Mina finds a logical explanation. There is at present reason to suggest that Al Mina was not only a market place where commodities produced somewhere in the hinterland were exchanged for goods brought by Greeks. It is quite possible that there were local workshops, producing various kinds of objects for Greek customers. The foundation of a settlement with a fairly permanent presence of Greek merchants should have attracted merchants and craftsmen from various small states in North Syria, especially given Assyrian aggression and the conquest of the Neo-Hittite North Syrian kingdoms in the second half of the 8th century B.C.[782]. In the Early Iron Age Syria was an important centre for bronzeworking, which was also known for its production of gold and silver personal ornaments[783]. Alone the excavations of Sam'al have yielded a large number of casting moulds, dated to the 9th-7th centuries B.C.[784]. Given the quasi-permanent presence of the Greeks merchants there, one can suggest that local craftsmen not only sold finished goods to, but worked to order for Greek customers. The find from Al Mina discussed above does not exclude the possibility that Greek

[780] See: I.J. Winter, 1979; B. Hrouda, 1971, 266; A.J. Graham, 1986, 58.
[781] D. Ridgway, 1992, 25.
[782] See, e.g. J.D. Hawkins, 1982, 409ff.; A.K. Grayson, 1991, 75-76, 86-87.
[783] See: I.J. Winter, 1988, 200-201.
[784] F. von Luschan, 1943, 23-25, Abb. 16; Taf. 8-9; R.-B. Wartke, 1980, 235-239, N 19-26.

metalworkers learned Near Eastern techniques of metalworking in a place such as Al Mina.

There are certain reasons to suggest that Eastern, i.e. Syrian metalworkers were not limited in their activities to Al Mina alone and that certain echoes and reminiscences may be traced even a hundred years later. A casting mould from Miletus, which was dated by its publisher to the first quarter of the 6th century B.C., was used for casting medallions with the Gorgoneion as a central element, boat-shaped earrings, heads of pins and fibulas of Phrygian type. The Gorgoneion, as it has already been shown, belongs to the Ionic type[785], The same is true for the boat-shaped earrings, which were known in the Near East at least since the second half of the 3rd millennium B.C.[786]. The elements of pins have parallels in Ephesus and Perachora[787]. At the same time, the fibulas cast in the mould belong to the Phrygo-Anatolian type, although they are of a variant designated by E. Caner as "*nicht-phrygisch bzw. Nachahmungen*"[788]. Thus, it is possible to identify it as an imitation of the Anatolian type of ornament engraved by a local Greek metalworker. One more detail is of interest—the design of the mould for casting boat-shaped earrings. It is different from the ordinary type of moulds for casting earrings, which provided the jeweller with a finished object. Instead, the Milesian mould was used to produce a semi-finished article in the shape of a "rudder" or "spearhead", both parts of the blade having then to be folded and the edge soldered in order to make an earring. The design of the earring cast on the mould from Miletus has very close parallels in the Near East. Especially similar is the design on moulds from Assur[789] and Ras Shamra[790]. In these moulds this same type of edge moulding is used to produce the effect of granulation. Other moulds for casting similarly designed earrings, although without pseudo-granulation, originate from Assur[791] and date to the Neo-Assyrian period[792], or from Sam'al (Zinčirli) from the excavations in front of the Barrekub Palace and date to between the mid-8th and the early 7th century B.C.[793]. Thus,

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785 R. Tölle, 1966, 93; C. Reinholdt, 1992, 228, Anm. 60.

786 See, e.g., O. Sargnon, 1987, 59, fig. 54-55; B. Musche, 1992, 103, Taf. XXXIII, type 3; 116, Taf. XL, type 4; 136, Taf. XLVII, type 2; 158-159, Taf. LVI, type 2; 173, Taf. LX, type 2; 179-180, Taf. LXII, type 1-2 etc.

787 See: R. Tölle, 1966, 92-93; C. Reinholdt, 1992, 228-229, Anm. 61-62.

788 E. Caner, 1983, 112, Abb. 3.

789 R.-B. Wartke, 1980, 229, N 5, Abb. 7.

790 J.-C. Courtois, 1973, 292-293, fig. 4.

791 R.-B. Wartke, 1980, N 8, Abb. 10.

792 R.-B. Wartke, 1980, 250, 252.

the motifs of the casting mould from Miletus show differing cultural backgrounds. With the design of the boat-shaped earrings, there are reasons to suggest a Neo-Assyrian or North Syrian metalworking tradition. It is no simple imitation of the shape of the earrings—the characteristic design allows us to assume that the craftsmen of the Milesian mould had at least seen Neo-Assyrian or North Syrian casting moulds[794]. The mould from Al Mina which is discussed above proves the co-existence of Northern Syrian metalworkers and Greek merchants in one of the earliest Greek trading posts in the Eastern Mediterranean. This conclusion can be compared to the view of D. Ridgway, who has supposed recently that among the silversmiths working at Pithekoussai there may have been some Phoenicians[795]. This find corresponds well with the distribution of pottery at Al Mina. Thus, the Syro-Palestinian pottery, which occurred in stratum VIII and upwards, is entirely absent below the floors of stratum VIII. Of great significance is also the fact that stratum VIII is the earliest stratigraphical level in which the three ceramic groups represented at Al Mina—Cypriot, Greek and Syro-Palestinian—are found together[796]. It has even been suggested that Cypriot and Syrian ethnic elements predominated over Greek ones at this time[797]. If one accepts the hypothesis recently proposed by J.N. Coldstream that mixed marriages are the explanation of the adaptation of the Eastern styles and techniques to the local Greek tastes and traditions[798], then such a mixture of motifs on the Archaic mould from Miletus finds a clear explanation—an Eastern, perhaps, a North Syrian metalworker, was among the ancestors of the Milesian metalworker. An indirect piece of evidence in support of this hypothesis can be found by analyzing so-called "Greco-Oriental" lead medallions. Some of these, on basis of their iconography, may be identified as imports or as the work of North Syrian craftsmen in Greece, while others have evident prototypes in the North Syrian-Hittite cultural area. At the same time the treatment of some motifs is typically Greek. The latter pieces are dated after the late 7th-early 6th century B.C.[799]. Another parallel is a

[793] F. von Luschan, 1943, 23, Taf. 8e; R.-B. Wartke, 1943, 237, N 21, Abb. 23.

[794] See the finds of Anatolian fibulas in Zinčirli: F. von Luschan, 1943, Taf. 43; E. Caner, 1983, 166, 178, 181f., 203.

[795] D. Ridgway, 1992, 99.

[796] E. Gjerstad, 1974, 117, 121.

[797] A. Sogomonov, 1985, 14.

[798] See: J.N. Coldstream, 1993, 97-100.

[799] O. Brehm, 1992, 68ff.

griffin protome from Miletus, dated as late as the first quarter of the 7th century B.C. which has recently been identified as the work of a toreut from Asia Minor who was well acquainted with Greek style[800].

The question of the sources of tin still remains open. If new studies prove the Iberian or North Atlantic origin of the tin ingots found off the Palestinian coast, and if one adopts the hypothesis of the "export of Eastern technology" shown by the study of C. Rolley, the following picture is seen. Eastern craftsmen were working in Greece, spreading the technology for the manufacture of tin bronzes, while tin was brought from the Western Mediterranean (Iberia or Brittany), perhaps, on Phoenician ships. If this schema is correct, then the role of Greeks in supplying tin from the West and their interest in it should not be considered to be of paramount importance. Another variant is also likely—that the Greeks obtained tin from the Taurus mountains (see above on p. 28) or from the Near East: some Greek centres, like Corinth and Argos, managed to obtain it, whereas others did not[801]. That ores were derived from various deposits and using differing extraction techniques is demonstrated by comparisons of iron impurities in metal from bronze tripods of Peloponnesian and Attic manufacture of the second half of the 8th century B.C.[802].

How are the finds from Pithekoussai to be interpreted? D. Klein, the author of the first publication, considers the following. A mass of imported ceramic was found in the excavations. What else but metals could have been exported from the island in exchange for these imported goods? While there are no ore deposits on Ischia, it is supposed that Pithekoussai was not a metallurgical, but a metalworking centre, which probably received raw metal from Central Italy (Populonia) or from Elba. The author follows G. Buchner, in thinking that the possibility of metalworking, based on the metals obtained from neighbouring territories, was the main reason which

[800] E. Akurgal, 1992, 41, Taf. 8, 3: "Die grosse stilistische Ähnlichkeit der milesischen Protome mit den von orientalischen Gastkünstlern produzierten Vorbildern dürfte wohl damit zu erklären sein, dass ein griechisch geschülter kleinasiatischer Toreut, der sie hergestellt hat, der orientalischen Kunstauffassung irgendwie artverwandt war. Die gegossene milesische Protome ist auch von den in Griechenland geschaffenen Exemplaren derselben Gattung stilistisch grundsätzlich verschieden".

[801] C. Rolley, 1983, 14; E. Magou et al., 1986, 133, 136; R.D. Penhallurick, 1986, 124-131; J. Elayi, 1988, 73 (about the Phoenicians coming to Cornwall in search of tin); E.A. Sanpaolo, 1990, 120-121, fig. 48, 50.

[802] E.A. Sanpaolo, 1990, 120, fig. 47.

attracted the Greeks to settle in Italy[803]. A. Rathje thinks that not only the Greeks but the Phoenicians as well were interested in the metal deposits of Etruria, whereas finds of Phoenician objects in the necropolis of Pithekoussai prove that not only Phoenician traders, but perhaps settlers as well had been there[804]. M. Frederiksen has shown that the trade in metals and metal objects preceded the settling of Greeks in the direct proximity of Etruria[805]. In an article, published in 1975, G. Buchner, analyzing gold ornaments from Etruscan necropoleis, made the suggestion that most, which had earlier been attributed to the Early Etruscan Orientalizing style, had been manufactured in Pithekoussai and, perhaps, later on, in Cumae. The main arguments for this suggestion are thought by Buchner to be not only the find of a weight and the interpretation of the use of word *chrusia* by Strabo (V.4.9), but the frequency of finds of such objects in Cumae and the fact that in the second half of the 8th century B.C. the special trade-economic conditions existed, under which the objects discussed could have been produced, only in Pithekoussai. Besides, the author supposes that the gold ornaments were manufactured by colonists from Euboea, who received metals from Etruria in exchange[806]. In 1979 G. Buchner maintains that after the find of an amphora with an Aramaic inscription in Pithekoussai the idea suggested earlier was given a more reliable corroboration[807].

Furthermore, D. Ridgway, basing mainly on the find of the weight, maintains "that jewellers' workshops at Pithekoussai, where silver and gold could be worked, are thus a real possibility—the archaeological demonstration of which has led to better understanding of Strabo's reference to *chruseia/ chrusia* as a feature of the Euboeans' prosperity in their first Western establishment"[808].

A special study of ancient iron working in Euboea and of the reasons for Chalcidian colonization in the West has been undertaken

[803] J. Klein, 1972. Similar point of view was expressed also by many scholars; see e.g.: A.M. Snodgrass, 1971, 335, 417; D. Muhly, 1973, 282; Ch.G. Starr, 1977, 62-63; M.M. Austin, P. Vidal-Naquet, 1977, 66; L.H. Jeffery, 1978, 63; I.B. Brashinskij, A.N. Shcheglov, 1979, 37 ff.; J.N. Coldstream, 1979, 221-226; O. Murray, 1980, 74. About various hypotheses concerning the reason of Pithekoussai foundation see: J. Close-Brooks, D. Ridgway, 1979, 120, 124, note 8; about the metal deposits of Etruria see also: *L'Etruria mineraria*, 1981; 1985.

[804] A. Rathje, 1979, 179 f.; see also: G. Buchner, 1982.

[805] M. Frederiksen, 1979, 284-286.

[806] G. Buchner, 1979, 135-138.

[807] G. Buchner, 1982, 296.

[808] D. Ridgway, 1992, 34, 95.

by S.C. Bakhuizen, who like most other scholars acknowledges the import of raw metal to Ischia[809]. The problem is determining, where iron was brought from. If one considers B. Kreulen's conclusion (see above on p. 37), one has to exclude the possibility that the mother city provided raw materials for the industries of its colony, Pithekoussai. The sense behind Bakhuizen's concept is that the reason for the earliest Greek colonization of the West was not import but export, that the Chalcidians had arrived as skilled craftsmen in regions which were technologically less developed. To use modern language, there was an export of technology on the basis of "know-how" from Central Euboea[810]. Analyzing the views of T. Dunbabin and J. Boardman, S.C. Bakhuizen notices that along with the export of copper and tin from the West to the East there may have been a same export of iron and the technology of iron smithing from the East to the West, so that, the hypothesis about migrant Greek ironsmiths should be taken into consideration as well as that about Greeks in search of metals[811]. Recently J. Boardman has expressed his view about the possibility that iron was transported from Euboea by the Greeks, however, not to the West, but to the East—towards Al Mina[812]. As A.J. Graham has reasonably stated, the very fact of finding a sample of iron ore in Pithekoussai does not prove that the Euboeans founded their colonies in Campania to mine iron or copper. At the same time, the availability of metals may have been an additional reason for the colonists to choose a site, which was satisfactory from other points of view[813]. P.G. Warden's observations also show this[814].

In J.M. Fossey's paper at the 1990 Vani symposium Bakhuizen's hypothesis was criticized. Fossey stressed in particular the absence

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809 S.C. Bakhuizen, 1975; 1976; 1981.

810 S.C. Bakhuizen, 1976, 65-67; see also S. Morris, 1992, 139-140. In that conjunction the analysis by Snodgrass of the materials found in the necropoleis of Italy is significative. So, in necropolis of Veji the sudden increase of iron objects took place in ca. 800-760 B.C. Iron was adopted in Etruria somewhat later than in other regions of Italy. In that context basing on the finds of Greek ceramics in Veji A.M. Snodgrass put a question, that the Greek search in metals stimulated the development of that process. See: A.M. Snodgrass, 1980, 362.

811 T. Dunbabin, 1948, 3, 7-8, 254; J. Boardman, 1980, 177; cf. S.C. Bakhuizen, 1976, 67, note 87.

812 J. Boardman, 1990, 185-186.

813 A.J. Graham, 1971, 43-45; *The Expansion of the Greek World*, 1982, 103; about the long-distance transportation of iron ore in Greece see: W. Rostoker, 1983, 255.

814 P.G. Warden, 1984. See also: A. Zifferero, 1991, 218 f., 223, 229-231; G.E. Markoe, 1992, 71-73.

of references to Chalcidian iron ores in Classical sources and that this *argumentum a silentio* contradicts what S.C. Bakhuizen supposes to be the important role of Chalcis in the field of ironsmithing[815].

Firstly, it is not a single example of such contradictions between the data of narrative sources, archaeometallurgical, archaeological and art historian studies of metal objects (see above). It seems evident that for the Geometric and Archaic periods one can not say that workshops tended to be sited nearer to raw materials. Even if this had occurred, it had local significance and, perhaps, was more characteristic of the working of precious metals.

At the same time, I can not be absolutely sure of the correctness of Bakhuizen's idea. What reasons are there to prove the special role of Euboean metal-smiths in the development of metalworking technology? What can be added to data about the existence of bronze and jewelry production in Eretria in the last decades of the 8th—7th centuries B.C. (see above on p. 45 f.)? Necropolis of Eretria of the second half of the 8th century B.C. has yielded a series of embossed diadems very similar to the contemporary Athenian ones, however characterized by a projecting tongue, the so-called "*Zungendiademe*", which were assigned by D.Ohly to a local Eretrian workshop[816] and one exceptional diadem from grave 14 of the West Gate Cemetery at Eretria of ca. 700-680 B.C. is decorated in Phoenician style and is thought to be made in a Cypriot (?) imported mould[817]. One more folded diadem was found, probably as a scrap metal in the above mentioned hoard of the jewellery[818]. Besides, A. Andreiomenou mentioned the find of a plain gold diadem of the Eretrian type with a tongue pattern dating to the first half of the 8th century, which, to his opinion, testifies to an early local workshop before the Oriental influences began[819]. That means, that in case of the foundation of the colony, the mother-city was able to send metalworkers. At the same time, Geometric bronzes found in Euboea are represented mainly by items imported from Attica and the Peloponnese, whereas bronze tripods from Lefkandi, where ca. 350 mould fragments for casting tripods were discovered, were more probably cast by the wander-

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[815] J.M. Fossey, 1990.

[816] D. Ohly, 1953, 46-52, E1, 2, 4, 5; R.A. Higgins, 1980, 104-105; S. Morris, 1992, 140-141.

[817] C. Bérard, 1970, 36-45; R.A. Higgins, 1980, 104-105; P.G. Themelis, 1983, 162.

[818] P.G. Themelis, 1983, 162-163, fig. 14.

[819] *The Greek Renaissance*, 1983, discussion, 165.

ing Argive founders than by local craftsmen[820]. What is, therefore, left to suppose? One can either adopt G. Buchner's hypothesis, that most of the gold ornaments from the Etruscan necropoleis were manufactured in Pithekoussai[821]. There are certain grounds for such an idea, remembering the existence of a local goldsmithing school in Euboea. Thus, the idea of the migrant Euboean iron-smiths does not seem to be supported by the concrete materials. Perhaps it would be more correct to propose the existence of migrant Euboean jewellers. However, Buchner's hypothesis has been recently discussed by several scholars. For instance, I. Strøm has come to the conclusion that the goldwork discussed was produced in the first quarter of the 7th century B.C. in a Cumaean goldworkshop, in which one or more Tarquinian craftsmen was engaged. The migrant craftsmen applied their traditional South Etruscan techniques to reliefs of Greek form, enlarging their decorative repertoire with Near Eastern motifs (South Etruscan goldwork seems to have been subjected to more than one way of foreign Near Eastern influences (North Syria, Phoenicia)[822]. G.E. Markoe has assumed silver vessels found in Etruria were not simply imported but actually manufactured on location by resident Phoenician craftsmen. Interpreted in this light, the Phoenician inscription on the silver bowl from Pontecagnano, which refers to its maker as the "son of the metalcaster", could thus refer to a corporation of immigrant Phoenician metalworkers resident in Italy. In Markoe's opinion, the evidence at hand, thus points to the important roles played by the Phoenician merchants and craftsmen in the exploitation of raw silver and the manufacture of finished silverwork from these sources. The existence of Phoenician workshops in Italy from the mid-8th century B.C. may have served a practical economic function in the procurement of silver: it is not far-fetched to imagine that at least some of the luxury tomb vessels were manufactured as trade goods in barter for native silver or were intended as "prestige" gifts designed to secure the cooperation of the local Etruscan chieftains responsible for access to native sources of the metal[823]. Therefore, the idea of G. Kopcke deserves attention. He maintains that sending the initial expedition to Ischia looks like another striking innovation driven by the same spirit of flexibility and experimentation. Greeks cor-

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[820] W. Fuchs, J. Floren, 1987, 64-65; see about bronze casting in Lefkandi: G. Zimmer, 1990, 19-20; S. Morris, 1992, 141.

[821] G. Buchner, 1979; 1982.

[822] I. Strøm, 1990; see also P.G. Guzzo, 1993, 132.

[823] G.E. Marcoe, 1992, 78-80.

porately saw their advantage not in challenging the Phoenicians' role as carriers and traders, but in acquiring land and settling. In its most essential effect, Pithekoussai proved to be the beginning not of an empire of traders, but of an export of settlers[824].

Already in the thirties, R.L. Beaumont put forward the idea that Corinth had tried to control the trade route by which silver was imported from Illyria. Among the arguments he mentioned was the practical absence of data proving Corinthian involvement in the Thracian zone of silver extraction and in the flow of silver from Iberia. The possibility that the Corinthians used silver, extracted from the mines of Siphnos, was excluded[825]. Similar points of view were adopted by T. Dunbabin and J.Boardman[826]. A.J. Graham states that the Beaumont's hypothesis is still prevalent today, because of the telling theoretical and indirect arguments in favour of it. As there is no exact evidence, it is difficult to say with certainty whether these suggestions are correct, however they are neither impossible nor improbable, for Corinth was a wealthy city-state with developed trading and industrial interests[827]. From the other point of view, some scholars, including M.I. Finley, consider that there is no evidence for the hypothesis of a monopoly of the Illyrian silver trade by Corinth[828].

In my opinion, decisive evidence for or against the hypothesis discussed may be sought in the results of lead isotope analyses of Corinthian silver coins. Eight such coins from the Asyut hoard have been analyzed. The results have shown that one of the coins was minted from Siphnian silver, five from silver extracted at Laurion and two from silver from the third as yet unidentified source of silver[829].

Some scholars consider the main reason for the Greek colonization of Thasos to be its gold mines[830]. However, let us not forget

824 G. Kopcke, 1992, 109.

325 R.L. Beaumont, 1936, 181-184.

826 T. Dunbabin, 1948, 248, 301; J. Boardman, 1980, 226.

827 *The Expansion of the Greek World,* 1982, 133.

828 See, e.g.: A.Yu. Sogomonov, 1984, 165.

829 N.H. Gale et al.,1980, 43, 48 f.

830 L.H. Jeffery, 1978, 181; A.J. Graham, 1978, 95; H. Kalcyk, 1983, 111 ff.; H. Matthäus, 1988, 20; C. Koukouli-Chrysanthaki, 1988, 178, Anm. 33.

See, most recently S. Morris, 1992, 143-146.Thasian minerals appear chiefly in titanium-rich hematite sands, a source of iron readily available on the seashore and convenient to seafarers like the Phoenicians. However, archaeological evidence for Phoenicians from Thasos is surpassed by its legends and minerals. She also maintains that attraction of Parian colonists to Thasos could have followed Phoenician exploration for metals, if Greek ventures abroad followed Levantine entrepreneurs (S.Morris, 1992, 145-146).

that according to archaeological data the mines found on the Acropolis of Thasos had been worked since the late 6th century B.C. The date of the so-called "Phoenician mines" is unknown, though it is thought that they had been seen by Herodotus. One recent hypothesis holds that a layer of iron slag, dating back to the 7th century B.C., proves that there was gold mining on the Acropolis of Thasos, however the author herself mentions that only a systematic study of ore and slag can lead to a conclusion that this was the reason for Parian colonization[831]. The Parian colonization of Thasos is dated to ca. 680 B.C. (its archaeological date is the mid-7th century B.C.). Judging by archaeological data, the Thracian population had settled the island at the time of the Parian colonization. The local inhabitants developed contacts with the Phoenicians; the presence of the latter is proved by the toponymic analysis[832]. However, R.J. Hopper considers it to be impossible that Thasian mines could be a reason for colonization long before the start of silver coinage[833].

Analyses of materials relating to the history of mining in Strandzha seem to give no basis to suppose that the colonization of the Western Pontic coast was motivated by the search of metals. In the North Pontic area there are a considerable number of remains of early workshops, some of which had been probably geared to the iron ores of Kerch-Taman region. This fact has however resulted in no hypothesis concerning the relation between colonization and the quest for metals. One can state with a fairly high degree of certainty that colonists there had tried to use the local sources of iron ore and, furthermore, that among them there had been smiths. Probably the existence of local natural sources had been taken into consideration with the other reasons for colonization, although one should not forget that most of the metalworking remains in the North Pontic area, judge by their dates, may be associated not with the activity of the first settlers, but with that of the second or even third generation of colonists. Therefore, the thesis that Greek colonization of the North Pontic area was late because of the absence of local metal deposits is erroneous[834].

Of special importance to the problem of the role of metals in the period of Greek colonization is the situation in Colchis. Scholars fol-

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[831] C. Koukouli-Chrysanthaki, 1988, 178, Anm. 33.
[832] A.J. Graham, 1978, 86 f., 89 f.
[833] R.J. Hopper, 1979, 38 f.
[834] I.B. Brashinskij, A.N. Shcheglov, 1979, 38; cf. F.V. Shelov-Kovedyayev, 1985, 52.

lowing Strabo (I.2.39) consider that the peculiarities of the Greek colonization of that region may be explained by the search for metals. No city-state with an agrarian economy developed in that area. In the period prior to the Greek colonization and during the process of colonization the coastal region of Colchis was covered by a dense network of local settlements with developed crafts and agriculture. The remains of many 9th-6th centuries B.C. smithies have been excavated[835]. As has been recently stated by D.A. Khakhutajshvili, "the practical absence of early materials related to iron metallurgy in the regions of the Eastern Transcaucasus, the Near East and the Aegean basin prove that the tribes of the Eastern and South-Eastern Pontic regions were the main manufacturers of iron for the lands mentioned above. The modern archaeological situation in these region allows us to make such a conclusion"[836]. M.P. Inadze states that settlements of the late 7th—first half of the 6th century B.C. originated in her opinion as a result of Ionian colonization in the south-western regions of Colchis, and were in fact trade stations, thanks to which the Milesians expanded their sources of metal, especially those of iron[837]. Recent finds have shown that in any case the 7th century B.C. saw the stout of a period of the widespread use of iron in Western Georgia and that from this time on the manufacture of iron in Colchis had a global character[838]. However, can one possibly see the search for iron and even for gold in Colchis as one of the reasons for Greek colonization there? The existence of developed local production does not definitely prove it. The argument that the inhabitants of Greek trading stations in the Colchian towns were merchants rather than craftsmen is difficult to accept. According to some scholars, this suggestion is proved by the fact that from the period, in which the first Greek items appear here, i.e. from the 6th century B.C. till the mid-4th century B.C., no single Greek article was manufactured on the site[839].

I have mentioned above that by the 6th century B.C. iron was wide-spread enough in Greece for its export from Colchis to be unnecessary. Finally the low level of Colchian ironmaking, asserted by

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[835] O.D. Lordkipanidze, 1977, 79 ff.; 1979, 322; 1985, 29, 35; 1991a, 128-129; D.A. Khakhutajshvili, 1979, 338; see also interventions of J. Bouzek, O.D. Lordkipanidze: *Tskhaltubo-II*, 1981, 385, 391; cf. J. Boardman, 1980, 239.

[836] D.A. Khakhutajshvili, 1987, 218.

[837] M.P. Inadze, 1982, 224-229.

[838] O.D. Lordkipanidze, T.K. Mikeladze, 1988.

[839] O.D. Mikeladze, 1974, 187; *Tskhaltubo-I*, 1979, 406; cf. the standpoint of A.I. Boltunova, in: *Tskhaltubo-I*, 1979, 206 ff.

D.A. Khakhutajshvili, is one more argument against the theory of its specialised "export": the character of the sites excavated speaks in favour of the view that the extraction of raw material and metallurgical activity were seasonal, most probably in the period between peaks in agricultural work, i.e. in the autumn and winter[840].

Regarding the situation gold sources in the period discussed may have been the following. Besides the Thasian gold mines scholars consider Lydia to be one of the main sources of gold. According to O. Davies, gold deposits in Lydia were not exploited until the Early Iron Age, C. Roebuck thought this could not have happened earlier than the 7th century B.C., although there is a view (S.Przeworsky) that Ionia had used gold from Lydia as early as in the second half of the 8th century B.C.[841]. W.Young has suggested more recently that the gold of Pactolus had been smelted even ever the 3rd millennium B.C., nevertheless recent studies have shown that the question of gold extraction so early in Lydia can hardly be raised at present[842]. Herodotus mentioned more than once the gold from the river Pactolus (I.69; V.101), and the last passage proves that the Greeks considered Sardis as a market for the acquisition of especially large quantities of precious metals. A new fragment from Heraclitus contains metaphors, which describe the process of smelting-refining "mountain gold". This is the place to mention that Ephesus was situated near a very rich gold deposit on Mt.Tmolus and the Ionians, judging by Heraclitus' terminology, knew the process of gold smelting down to the details[843]. In either event, the earliest gold-smelting workshop excavated at Sardis is dated to 620-550 B.C.[844]. Thus, at the moment of Greek colonization of the Colchian littoral gold was smelted in the direct vicinity of the Ionian centres. There are only few sources available in connection with the early links between the region to the East of the Black Sea and the Greek world[845]. It seems that the foundation of the Greek *apoikia* in Colchis may be associated with the pressure of Persia after the conquer of Lydia in 546 B.C. In this case the Greek settlers were obliged to found colonies without thinking of raw resources, or climate of Colchis. And in the mid-6th century B.C. the

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840 D.A. Khakhutajshvili, 1987, 214-215.
841 C. Roebuck, 1959, 88; *The Expansion of the Greek World*, 1982, 215.
842 J.C. Waldbaum, 1983, 3 f.
843 A.V. Lebedev, 1979, 13 f.
844 J.C. Waldbaum, 1983, 7 with bibliography.
845 See. G.R. Tsetskhladze, 1994b, 79-80.

coastal area of Colchis was the only region in North Pontic area which was not settled by the Greeks[846].

Therefore, the hypothesis that the quest for metals was the reason for Greek colonization in Colchis is not well argued, especially given that the Greek towns of the South-Eastern Black Sea coast have not been studied archaeologically.

There is also a view that the reason for early Ionian, particularly Milesian colonization of the southern coast of the Black Sea was a desire to control the routes connecting the coast with the metalliferous regions of Anatolia[847]. C. Roebuck thought that Ionia had practically no deposits of iron ore and suffered difficulties with iron supplies. Since the late 7th – 6th centuries B.C. new sources were opened up, perhaps, some iron being brought by the Phocaeans from Etruria, and after the colonization of the southern coast of Pontus, Chalybean steel was supplied in Aegean markets. However, the earliest narrative evidence for the export of Chalybean steel is dated to as late as the first half of the 5th century B.C., when it was valued higher than local items. According to C. Roebuck, it was first exported by Ionian merchants after the mid-6th century B.C., perhaps, primarily via Amisus[848]. R. Drews gives as evidence for proves his theory the wide diffusion of iron and silver deposits and their proximity to Trapezus, and considers that it was founded as a trading station of Sinope by the Corinthians and by inhabitants of other Greek city-states for the export of metals. By analogy R. Drews cites the example of the export of iron ore from Elba to Pithekoussai discussed above and a passage from Homer (Od. I. 184). However, Drews himself is puzzled as to why the Greeks had to import iron and silver to the Aegean, where deposits of these metals existed, and explains this by the fact that we have little idea of the situation concerning metal supply, which in reality occurred in the mid-8th century B.C. R. Drews mentions besides that in the 5th century B.C. neither the Athenian League of

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[846] See G.R. Tsetskhladze, 1992, esp. p. 256-257: "The Greeks, after arriving on the east coast of the Black sea, had until then only a very vague idea of Colchis...The Greek settlements were unable to develop into *poleis* of the classical type, because they were not in a position simply to assimilate the local Colchian society, and lacked the opportunities for direct exploitation of local resources in view of the special features of climate and demography".

[847] L.H. Jeffery, 1978, 210; J. Boardman, 1980, 248; O. Murray, 1980, 101. J. Hind's reference on Prentiss de Jesus' publication in which it is stated as though the search in metals was a reason of Greek colonization in that region is erroneous; see: J. Hind, 1984, 95; cf. P. De Jesus, 1978.

[848] C. Roebuck, 1959, 101-103.

maritime states nor the Persian empire had great interests in the south coast of the Black Sea. Regarding the source of Greek knowledge of Cappadocian metals, the author considers that this may have reached Greece via Urartu[849]. R.Drews' view was recently criticized by J. Hind[850]. One should note that there is no archaeological or archaeometallurgical evidence for the theory of a "metallic colonization" of the southern littoral of the Black Sea.

Let us turn to the situation in the Near East. According to certain scholars, Euboean merchants visited Al Mina to expand their trade in metals brought to the coast from the rich sources situated inland[851]. I.J. Winter even associates the destruction of the VIIth layer of Al Mina, approximately synchronous with the destruction of Tarsus by Sennacherib with the Assyrian drive for metal resources in Anatolia. It is as a result of losing of a source of iron in the Near East that he considers the start of Greek exploitation of iron ore in Hallstatt Europe[852]. A.Yu. Sogomonov draws attention to the fact that the idea of Greek export of metals, primarily, iron, from the East has not been supported by documentary evidence. Perhaps, the Cycladeans were attracted by the tin markets of Levant, but that remains only a tempting suggestion[853].

The attempt by V.P. Yajlenko to link historical and legendary tradition, stressing the role of Argos in Pamphilia and Cilicia with the development of the city-state as one of the largest metalworking centres of Greece in the 8th-7th century B.C., seems a forced interpretation. In either event the find of iron braziers and a helmet of the Assyrian type in a grave with a suit of armour of the Eastern type (cf. numerous finds of the Eastern objects in Greek sanctuaries—above on p. 106,113) hardly point "to the Argive interest in the Eastern market, providing metal for its armories and other metal workshops"[854]. Furthermore, this author, following J. Boardman and J.Bing, states that not only Argive merchants, but also those from Rhodes were attracted to Cilicia by the richness in its metals, considers that the tribute, which the Kings of Assyria received from there, may have also been the object of Greek interest[855]. Even if

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849 R. Drews, 1976, 26-31.

850 J. Hind, 1988.

851 L.H. Jeffery, 1978, 63; J. Boardman, 1980, 42; O. Murray, 1980, 73; *The Expansion of the Greek World*, 1982, 13; I.J. Winter, 1988, 210-211.

852 I.J. Winter, 1988, 211-212.

853 A.Yu. Sogomonov, 1985, 11 f.; cf. the point of view expressed by C. Rolley, and the results of studies of iron objects from Greece by G. Varoufakis- above.

854 V.P. Yajlenko, 1990, 159.

855 V.P. Yajlenko, 1990, 164-165.

this was so, the interests of the Assyrian rulers were much broader, they were limited not only to the metals, but also included slaves, cattle, wool and linen clothes etc.[856].

Having discussed hypotheses concerning the connection of Greek colonization with the search for metals, I would like to note the following. The geographical scope of these suggestions is extremely wide: from Iberia in the West to Palestine, and the southern and eastern coasts of the Black Sea in the East. The chronological range is broad as well: from Al Mina and Pithekoussai to the 6th century B.C. colonies. The hypotheses analyzed discuss from the given standpoint practically all the currents in the Greek colonization movement, admittedly in a limited way, except for Doric colonization.

Let us look now at, how the hypotheses discussed correspond to the various models of Greek colonization. The three main models of colonization were outlined by I.B. Brashinskij and A.N. Shcheglov[857]. Analysis of these hypotheses shows that all cases belong either to the first or to the second model (1st: colonization of regions occupied by a compact group of a numerous sedentary population with fairly developed organization of society; 2nd: the foundation of colonies on the territories of Eastern states). Naturally, in the case of an unstable population or an uninhabited region of colonization, how, in spite their own practices, could Greek settlers obtain information about metal sources in that territory? Perhaps, this situation occurred in the North Pontic area. Besides, how could they exploit metal deposits, given, that the numbers of colonists were usually rather small?

A.J. Graham's view of the reasons for colonization (the 3rd volume of the Cambridge Ancient History) is worth attention. In his opinion, by discussing the motives for colonization, especially by explaining it in forms of grain trade or a search for metals, scholars may achieve at most only approximately truthful hypotheses. The reasons for colonization are often only postulated; the evidence that such were main reasons for colonization is very rare or most often is absent. In either event it is difficult to find explanation. In Graham's opinion, most of the Greek colonies were agricultural, nevertheless there was hardly a colony without trading interests; in many of them the existence of trade was very important; and in some colonies it was even overwhelming significance[858].

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856 See: V.P. Yajlenko, 1990, 165.
857 I.B. Brashinskij, A.N. Shcheglov, 1979, 36 ff.
858 *The Expansion of the Greek World*, 1982, 159.

During the recent period, there has been increasingly frequent expression of the view that the Greeks who founded the colonies were interested primarily in the supply of raw materials. In that connection, one could even expected a theory of "raw materials" colonization instead of "trade" colonization[859]. Analyses of data obtained by advances in the natural sciences and archaeometallurgy lead me to treat this theory with caution and in every case to thoroughly study and interpret the facts. This also applies to the suggestion about the correlation between metal export and colonization.

In this sense, it seems barely probable to put forward a search for metals as a reason for the early Euboean colonization and for Milesian colonization of the Black Sea coast. Even if one adopts G. Buchner's hypothesis that the craftsmen working at Pithekoussai manufactured the ornaments for Etruria in exchange for raw materials, this still does not prove that the desire to get nearer to sources of raw materials in Italy was the reason for the foundation of a colony on Ischia.

It is noteworthy to mention D. Ridgway's view on the sources of raw materials for metalworking on Ischia. He maintains that all the raw metals had to be brought, suggesting, e.g., that Pithekoussan silversmiths were dependent on Phoenician suppliers operating out of Sardinia or Spain. He stresses a staggering amount of human labour which was inevitably required to transport heavy raw material[860].

To my mind, it is premature to propose the dependence of colonization on the search for metals in other cases as well. In the case of Phocaean colonization in the West the following is evident: in the south of the Iberian peninsula there have been finds of Greek imports, analyses of which prove with some certainty that they came via the Phocaeans after the last quarter of the 7th century B.C. and in course of the 6th century B.C. At that time copper and silver were extracted from the mines of Huelva, however, Greek ceramics appeared there later, and Phoenician ware has been found in considerable amounts. There is other data to support the view, that Iberian silver, if it ever reached Greece, was brought by the Phoenicians, who are supposed to introduce such

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[859] See: Yu.G. Vinogradov, 1983, 383.

[860] D. Ridgway, 1992, 99-100. The possibility that Phoenicians supplied Tartessian silver to Pithekoussai and Greece on the whole is suggested by some other scholars, see, e.g. M.-E. Aubet, 1993, 240.

large quantities of silver from Rio Tinto mines in Huelva into Western Asia, roughly between the years 720 and 650 B.C., that brought about a fall in the price of the metal in the days of Assurbanipal, in the middle of the 7th century[861].

Analyses of the silver coins of various Greek mints has shown that they were coined in the main from silver from Laurion and Siphnos. These mines could probably satisfy the demands of the Greek city-states. However, the coins analyzed are dated not to the first half of the 6th century B.C., the supposed period of the most intensive import of silver from Iberia, but to a somewhat later period, so that the hypothesis about the import of Iberian silver still needs to find analytical support. It seems that the analysis of Phocaean coins could give an answer to this question. The electrum coinage of Phocaea has been studied by F. Bodenstedt. Analysis has shown that in course of time the gold content of the coins became lower, while that of silver was growing, reaching its the lowest point in coins dated to 600-522 B.C.[862]. However, it is quite probable that the increase in the silver content of the coinage of Phocaea may be dated to an even later period; the second chronological group identified by F. Bodenstedt should be dated, perhaps, to the later period[863]. It is most probable that until the second quarter of the 6th century B.C. the process of cementation had yet to be discovered: this is proved by varying gold concentrations in the electrum coinage of different Asian Minor centres of the first half of the century. Perhaps, the widespread appearance of silver coinage in Asia Minor after the mid-6th century B.C. was connected with the discovery of this process[864]. Therefore, it is difficult to see the electrum coinage of Phocaea as an alloy of gold obtained from electrum by cementation techniques with Iberian silver.

Thus, the only credible argument of the adherents of the "metallic" colonization theory is the existence of Greek imports. However, as is known, the vary fact of imports does not always prove the

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[861] M.-E. Aubet, 1993, 63-64. Cf. R.J. Forbes, 1950, 196: "It has been suggested that the Phoenician traders were responsible for the frequency of silver in the Near East in the first millennium and that this silver was obtained by them from the mines in Sardinia and Spain, but the part which Phoenician trade played in early history has been grossly overrated... Closer contacts in the Ancient Near East in this period, the abundance of rich deposits and metallurgical skill in several regions are the reasons for the abundance of silver in this period and fit into the logical development of metallurgy in the Near East".

[862] F. Bodenstedt, 1976; 1981; cf. R.F. Tylecote, 1978; Z. Stos-Gale, 1982.

[863] J.P. Guepin, 1979, 218; M.B. Wallace, 1983, 287.

[864] R.M. Wallace, 1987, 391-392.

existence of trade relations[865]. Even if it can be shown that tin from Brittany or Iberia was exported to the West or tin was brought from the Near East, this by no means proves that one can with certainty explain Phocaean colonization or the mastering of the Levant in terms of the search for metals, because, as has been shown by recent studies, "an export of technology" occurred of tin-bronze manufacture from the East, whereas metal was most probably brought from the West on Phoenician ships.

Perhaps, there were other trade routes. The theory of S.C. Bakhuizen about the reasons for Euboean colonization in the West in which the Greek craftsmen—the bearers of modern technology to the regions of colonization—took part deserves attention. Until the decisive arguments have been found one cannot exclude the mother city as a source of raw materials for the crafts of its colonies. Even in those cases where metalworking flourished in the early stages of a colony's development, as, e.g. in Pithekoussai, Pantikapaion, Berezan or the Yagorlyk settlements, the search for metals may not necessarily have been the reason for the colony's foundation. There may be other explanations: a demand for metal objects: as implements, tools both in the process of town building and as weapons in conditions of a hostile barbarian environment: and the manufacture of metal articles and ornaments to trade with the barbarians.

It seems to be truth in the view that in the process of founding colonies the primary consideration was the degree to which the site chosen satisfied the conditions necessary for the normal functioning of the inhabitants, i.e. first of all the interests of the migrants, not those of the mother city[866]. Finally, although the Greeks imported metals, also via their colonies[867], this does not at all mean that the colonies were founded to provide such imports. One should not exaggerate the role of trade in early Greek society[868]. Many scholars at present hold the view, that, for instance, trade in the Archaic epoch took the form of gift exchange—which could explain the sometimes unexpected finds of ceramics[869]. It is sup-

[865] D.H. French, 1982, 21; D.J.W. Gill, 1991.

[866] F.V. Shelov-Kovedyayev, 1985, 55.

[867] G. Varoufakis, 1975; M.M. Austin, P. Vidal-Naquet, 1977, 295; A.M. Snodgrass, 1983, 22-25.

[868] *The Expansion of the Greek World*, 1982, 426; M.I. Finley, 1983c, 190; K. Hopkins, 1983, X-XIV; A.M. Snodgrass, 1983, 26; G. Kopcke, 1992, 112. Especially extreme view is expressed by T. Rihhl (1993).

[869] M.I. Finley, 1983a; A.M. Snodgrass, 1980, 128, 224; 1983; J.N. Coldstream, 1983, 203, 207; I. Hahn, 1983, 30.

posed that in the period in question trade in metals in the Greek world had the character of private initiative and that important role in the 8th-7th century B.C. Greek trade was played by the aristocracy along with the just appearing independent maritime traders[870]. Moreover, it is necessary to remember that apart from well-known factors such as overpopulation and a lack of land[871] other reasons, hardly detectable in the preserved sources, may have influenced Greek colonization. In this respect the hypothesis, expressed by J. Mac Camp II is of interest. Basing himself on archaeological and narrative sources this scholar supposes that the colonization movement of the late 8th – early 7th centuries B.C. was to a considerable extent influenced by drought and the epidemics following it[872]. Rather similar view is shared by G.L. Cawkwell: "Colonisation in the eighth and seventh centuries was...the cure not of the endemic evil of over-population but of the epidemic woes of climatic disaster"[873].

Furthermore, one should remember the exterior factors, like the Persian pressure, the destabilisation of the Lydian Kingdom etc.[874]. Although I can not believe that it might have been a general reason for Greek colonization, the hypothesis has been recently put forward by T. Rihhl that early Greek *emporia* were founded for the "honourable business of man-hunting", or production slaves[875]. Thus, one should not mix or seek to find interdependency between the two processes: trade in metals and the colonization movement.

M. Elat has come to the similar conclusions, analyzing Phoenician colonization in the Western Mediterranean[876]. In his opinion, Phoenician-Iberian relations underwent two stages, corresponding to two periods in the history of Phoenicia. In the first stage

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870 M.I. Finley, 1970, 604; Ch.G. Starr, 1977, 68; C.M. Reed, 1984, 32-36.

871 See, e.g. J.N. Coldstream, 1977, 311.

872 J. Mak Camp II, 1979; see the critics: A.M. Snodgrass, 1983a, 170 f.; *The Greek Renaissance*, 1983, 34, note 5; 115, note 2; 211.

873 G.L. Cawkwell, 1992, 302.

874 See P. Rouillard, 1991, 206 with references: notes 44-45. G.A. Koshelenko, V.D. Kuznetsov (1992, 25) also maintain that as the result of Persian pressure and fall of the Lydian kingdom the Ionian Greeks were obliged not only to endure economic losses and, as a result, live in conditions of growing social tension in the cities, but also renounce the level of prosperity and culture to which they were accustomed. This meant that the very principles underlying the existence of the polis were under threat. See also G.R. Tsetskhladze, 1994a, 125f.

875 T. Rihhl, 1993, 95 ff. See, e.g.: "Other early pioneers were the Euboeans, about whom all I shall say here is that they were renowned in antiquity as "far-famed lords of war", not far-famed smiths".

876 M. Elat, 1982.

Phoenicia, like the other states of Syria and Palestine, was independent, and Phoenician merchants brought silver from Iberia (Diod. V. 20. 1-2; 35. 1-5). M. Elat states that the Phoenicians were not forced to leave their motherland in order to settle in distant areas of the Western Mediterranean in the first period. A passage from Herodotus (IV. 196), describing how the Carthaginians exchanged their wares for gold clearly illustrates the possibility which had been opened to the Phoenicians to establish trade contacts in the Western Mediterranean and to import the metals they desired without moving whole communities. Perhaps, that is why, the infrequent finds of Phoenician imports in the Western Mediterranean date to before the second half of the 8th century B.C. Judging by the archaeological data, Phoenician colonization started in the second period of western contacts after Phoenicia was conquered by Assyria in 737 B.C. and lasted into the 7th and the first decades of the 6th centuries B.C. M. Elat considers that it was political and economic pressure from Assyria and Babylon on Phoenicia that provided the reason for Phoenician emigration and the foundation of colonies in the Western Mediterranean[877]. That view is rather common in defining the reasons of the Phoenician expansion in the Western Mediterranean. H.-G. Niemeyer has recently suggested that Phoenician settlements, which he designates not as colonies, by rather ports of trade (see above on p. 150) were designed and established during the 8th and 7th centuries B.C. only to consolidate and secure early trade relationships which were threatened by the new and aggressive colonization movement of the Greeks. Due to the strong, unbroken Bronze Age tradition in Phoenician culture, these trading and manufacturing settlements probably followed the old oriental Karum model, though in more one-sided manner. This would have included merchants, agents, and craftsmen, in a type of community designed to exist just outside the walls of a foreign city[878]. Other authors, like W. Albright, W. Röllig, S. Morris from a completely different standpoint, state that the main causes of the diaspora were the internal dynamics of Phoenician society and the inexhaustible demands for raw materials, basically metals[879]. O. Negbi, for example, has recently maintained that Phoenician

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[877] M. Elat, 1982, 66-68.

[878] H.-G. Niemeyer, 1990, 488.

[879] See: P. Barceló, 1988, 35; H.-G. Niemeyer, 1989, 23. S. Morris, (1992, 125, note 99 with references) for instance, states: "Levantines neither emigrated as refugees from imperial power, nor were they crippled by tribute, but enjoyed a profitable relationship with resources and raw materials".

colonial activities had started in the early 12th century B.C. and were already well established by the end of the 10th century B.C.[880]. M.-E. Aubet has come recently to the conclusion, that there was no one causal factor but that the diaspora arose from the coming together of various interrelated factors over a long period of time, among which the demand of metal for the specialized industries of Tyre was essential and the supply of silver to the Assyrian Empire, which experienced a shortage of silver between the end of the 9th and the end of the 8th centuries[881].

Thus, although the import of metals certainly created conditions favourable to the development of long-distance overseas trade practices[882] and preceded colonization, it was either not the single reason for the latter, or a specific case which may be explained by the existence of specialized metal industry in Phoenicia and specific economic and political conditions.

No one of the Greek cities of the 8th and 7th centuries B.C. had such a highly developed metal industry specializing in the manufacture of luxury and prestige articles destined for international trade and supply to the neighbouring Near Eastern courts as Tyre had.

The fact that the Greeks sailed overseas and brought back metals before the era of colonization is proved both by a passage in Herodotus about the voyage of Colaeus (IV. 152) and by analysis of a passage from the Odyssey (I. 184). However, the voyage of Colaeus had a semi-commercial, semi-piratical character[883], whereas the second episode, the exchange of iron for copper, may be interpreted as a "gift exchange"[884].

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880 O. Negbi, 1992.

881 M.-E. Aubet, 1993, 51 ff.

882 Ch.G. Starr, 1977, 67.

883 J. Velissaropoulos, 1980, 27.

884 S. Morris, 1992, 119: "The first book of the Odyssey introduces this world where iron and copper travel the Mediterranean, sometimes in opposite directions on the same ships".

CHAPTER THREE

# THE ROLE OF METALS IN THE CLASSICAL ERA

## *3.1. Mining according to the Classical Written Sources*

According to Herodotus (VII. 144), in 484/3 B.C. new rich veins of silver-lead ores were discovered in Laurion. It is assumed that from the 480-s B.C. onwards the Athenian state established control over mining, which led to the prosperity of the city. Themistocles was thus able to invest 100 talents in the construction of the fleet which won victory at Salamis. However it is probable that the exploitation of new rich deposits had begun somewhat earlier, perhaps in the last quarter of the 6th century B.C., to judge by the analysis of Attic coins (see above on p. 24)[1]. Mining stopped in 480 B.C. because of the devastation of the area by the Persians. The exact date at which mining was restarted is unknown: in any event Ch. Starr's suggestion that a large number of Athenian "owls" was coined after the Peace of Kallias in 449 B.C.[2] is corroborated by the results of archaeological investigations in Thorikos (the chiatus of 480-450 B.C.). The rare 5th century B.C. epigraphical and literary evidence for the state control of mines are represented by an inscription dating ca. 423 B.C. and some passages from Aristophanes. The high level of exploitation (recent calculations by C.E. Conophagos have suggested a possible output of 20 tons of silver per year in the 5th century B.C.[3], although this figure should be used with caution[4]) remained stable up to the Peloponnesian War, i.e. till 413 B.C., when the Spartans occupied Decelea to the north of Athens. According to Thucydides (VI. 97.7), more than 20,000 slaves absconded from the mines to join the Spartans. S. Lauffer considers that these

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[1] H. Montgomery, 1984, 127-128.

[2] Ch.G. Starr, 1970, 81-85; cf. H. Montgomery, 1984, 128.

[3] C.E. Conophagos, 1980, 341-354. According to his calculations, in the period from the 7th to 1st century B.C. the mines of Laurion yielded 4.000.000 tons of the ore mineral, of which there was extracted 3.500 tons of silver and 1.400.000 tons of commercial lead. See also: C.E. Conophagos, 1989, 272.

[4] D.W.J. Gill, 1991, 39, note 93.

20,000 slaves did not include very many miners, referring to the fact that in 409 B.C. the Athenians had constructed defences in the region (Xen. Hell. I.2.1)[5]. B.S. Strauss reasonably mentions that the slaves could have escaped between 413 and 409 B.C. and in spite of the loss of workers the mines may have been exploited up to 406 B.C.[6]. A.I. Dovatur considered that the majority of slaves who joined the Spartans had escaped from Laurion[7]. The results of studies of a Belgian expedition to Thorikos seem to confirm the last hypothesis, although the possibility of such precise dating of ordinary archaeological materials seems improbable (see below on p. 188). According to G. de Ste Croix, most of the escaped slaves were *cheirotechnai*[8], the term normally used to designate of craftsmen or artists, but it can be understand in a more general sense to mean qualified workers or experts. Thus most of them could not have been mine slaves. The view is adopted by L.M. Gluskina[9]. D. Kagan, analyzing Ste Croix's hypothesis, considers that not all of *cheirotechnai* were mine slaves or workers in the silver mines[10].

The evidence for the new exploitation of the Laurion mines in the 4th century B.C. is formed by tribute lists of Athenian *poletai* dating between 367 and 306 B.C. and some literary evidence, for example a pamphlet by Xenophon. In ca. 340 B.C. mining at Laurion reached its highpoint. At that time the state annually leased around 140 mines for between 3 and 7 years each. The annual output of silver is estimated in 26.2 tons, of lead 8.7 tons[11]. The processing of ore and smelting of silver and lead took place on the spot. This is demonstrated by the excavation of numerous installations for ore washing. It is thought that ore smelting was centralized, because the process required specially trained workers. Whatever the case, there is mention of only six furnaces in the vicinity of mines, in comparison to 220 other objects. This fact probably explains why so few furnaces were found during excavations (five furnaces were unearthed by the Belgian expedition to Megala Pevka)[12].

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5 S. Lauffer, 1979, 220-222.
6 B.S. Strauss, 1986, 46; see also: L.M. Gluskina, 1984, 188, note 11.
7 A.I. Dovatur, 1980, 77.
8 G. Ste Croix, 1972.
9 L.M. Gluskina, 1984, 188, note 11.
10 D. Kagan, 1987, 67-68.
11 S. Isager, M.H. Hansen, 1975, 44-45.
12 S. Isager, M.H. Hansen, 1975, 102.

After approximately 330 B.C. the number of lease treaties diminishes. The last piece of literary evidence, that of Demetrius of Phalerum, dating to ca. 310 B.C., is cited by Strabo (III. 2.9)[13].

Herodotus (V. 17) described the route from Lake Prasias in Macedonia past the mine, which brought the Macedonian king Alexander I (495-450/40 B.C.) a talent of silver a day. This mine is to be located in the modern mountains of Crusias to the north of Salonike, where deposits of precious metals are known, or in the region of Pangaeus[14]. Besides this, the Macedonian king exploited gold mines in the western part of the Strymon basin, alluvial gold on the river Edon, renamed on that occasion as Ehedor, or "giving gold". For the first time in its history, the Macedonian Kingdom had the prerequisites for the minting of coinage[15].

The most important gold mines exploited in the Classical period were situated in Southern Thrace and Macedonia. The system under which the Thracian mines were exploited has been reconstructed with a high degree of probability for the Early Classical period. The mines on Mt. Pangaeus formed a separate group: both Herodotus (VII. 112), whose information dates to ca. 493 B.C.[16], and Strabo (VII. 34) mention the extraction of gold and silver. However, there is a point of view, that originally only silver was mined in Pangaeus, whereas the extraction of gold from local pyrites began not earlier than the 5th, and probably even the 4th century B.C. This suggestion seems to correspond to a passage from Diodorus (XVI.8.6-7), stating that the mines of Pangaeus were insignificant until the time of Philip II, who improved them and increased ore output: only the output of gold could have been "insignificant", since silver was certainly extracted in higher volumes[17]. According to Herodotus, the deposits were exploited by various Thracian tribes, who still owned the mines in 382 B.C., as we know from Xenophon (Hell. V.2. 17)[18]. The metals mined by the Thracians were probably sold by them at an emporium, established on the Thracian coast of Thasos, which became one of

[13] R.J. Hopper, 1968; S. Lauffer, 1975; H. Kalcyk, 1983, 16-19; E.J. Jones, 1984, 79-81; R. Osborne, 1985, 111-126; G. Heinrich, 1986, 403-404; S. Ito, 1986; D.I. Rankin, 1988.

[14] R.J. Forbes, 1950, 198; E. Pernicka, 1987, 677; cf. E.N. Borza, 1982, 9-10, note 21.

[15] N.G.L. Hammond, 1989, 45-46.

[16] R.J. Forbes, 1950, 151; B. Isaac, 1986, 21.

[17] E.N. Borza, 1982, 10; *Makedonen*, 1994, 151 (Ch. Koukouli-Chrysantaki; I. Vokotopoulou).

[18] B. Isaac, 1986, 48-49.

the reasons behind Athenian claims to Thasos in 465 B.C. At the same time, the Thracians exploited a gold mine (Thuc. I. 100.2) or mines (Hdt. VI. 46. 3) at Scaptesyle on the Thracian coast opposite the island, which came under Athenian control in 463 B.C. There is a reason to suppose that only in 360/59 B.C. with the establishment of the Thasian colony of Crenides, later renamed Philippi after its capture by Philip II, did the Thasians retake for a short period of time a gold mine at Scaptesyle[19]. Finally, the third region of metal extraction, as was pointed out by Strabo (VII. 34), is situated on either shore of the Strymon, i.e. near Eion and Ennea Hodoi (the future Amphipolis), where gold mines existed which were exploited by the Thracian tribe of the Edonians. After the Athenians sent 10000 settlers to the area at the start of the siege of Thasos and occupied Ennea Hodoi, the Thracian army defeated the colonists and recovered the mines of the Strymon valley. However, the Athenians could buy the metal, as they did wood, via the port of Eion, which remained under their control[20].

M.I. Finley states that this fact forms the only evidence of state exploitation of confiscated property: the mines were worked by leaseholders, as they had been before their capture, however the Athenian state received its share of their incomes, as was the case at Laurion[21].

In 437 B.C. the Athenians founded Amphipolis. In the late 5th century B.C. among an inventory of the treasury of Athena (IG I$^2$, 301B, 1.103 f., 116 f.) are mentioned objects of Scaptesylian gold, showing that gold from Scaptesyle reached Athens. It is known that the gold mines in that part of Thrace were owned by Thucydides (Thuc. IV. 105). P. Perdrizet's interpretation that Thucydides owned a concession, enabling him to exploit the mines and sell the metal, has been widely accepted[22]. B. Isaac thinks that the term '*ergasia*', used by Thucydides, meant mine workings, which were conducted by slaves under the control of a manager[23]. The official statute of the mines for both Athenians and Thracians is unknown, although a passage from Plutarch to the effect that Thucydides had inherited the mines at Scaptesyle from Cimon and Olores, a Thracian dynast (Plut. Cim. 4), allows us to identify them as the mines captured by Cimon in 476 B.C.

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19 B. Isaac, 1986, 49.
20 B. Isaac, 1986, 21-30.
21 M.I. Finley, 1983, 21.
22 See, e.g.: T.D. Zlatkovskaya, 1971, 119-125.
23 B. Isaac, 1986, 32.

during the conquest of Eion. Thus, the extraction of Thracian precious metals proves the existence of close relations between Athenian noble families and the Thracians. All Athenian attempts in course of the 5th century B.C. to expel the Thracians and establish colonies to exploit the mines failed[24]. P. Perdrizet was thus evidently right in assuming that after their victory over Thasos the Athenians had not been able to achieve the main aim of the campaign because the mines remained in the hands of the Thracians[25].

The mines of Chalcidike, situated between the lakes of Volvi and Coronea and the southern slopes of the Central Chalcidian mountain ridge, were one of the main areas of mining activity in Macedonia. According to E.N. Borza, they were not exploited before the mid-4th century B.C.; it is also not clear whether the mines had been originally worked by Olynthus or by Philip. This suggestion is based on the fact that in an Acanthian speech in Sparta of 383 B.C. (Xen. Hell. V.2. 16-17), which mentions practically all the resources of Chalcidike and Olynthus, including its ships and forests, its income from trade, its large population and plentiful food supplies, nothing is said about the mineral resources of the region[26].

The mines to the east of Pangaeus, captured by Philip II in 358/7 B.C., yielded an annual income of 1000 talents. To the mid-4th century B.C. gold was certainly mined on Mt. Stratonike and in the first half of the century in the area of Lampsacus. The gold deposits of Paeonia and Samos, mentioned by Aristotle, are thought to be doubtful by J.F. Healy[27].

The silver deposits at Stageira were exploited by the inhabitants of Acanthus. The silver mines of Damastion in Epirus (Strabo. VII. 7.8) were, according to J.F. Healy, worked in the Classical period[28], although Strabo did not mention at which periods mining occurred, it could have taken place in the Hellenistic period. Aristotle's testimony for Melian mines seems to be confirmed by geological data. Silver was also mined in Metimne on Lesbos and in Sardinia[29].

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[24] B. Isaac, 1986, 31-34.
[25] P. Perdrizet, 1910, 20-22; T.D. Zlatkovskaya, 1971, 123.
[26] E.N. Borza, 1982, 11.
[27] J.F. Healy, 1978, 46.
[28] J.F. Healy, 1978, 53.
[29] J.F. Healy, 1978, 53.

Artemidorus mentioned that a copper mine at Adramyttium in Asia Minor was still in use at the time of Alexander the Great[30].

### *3.2. Mining in the Light of Archaeological and Archaeometallurgical Studies*

To judge by the results of archaeometallurgical investigations, lead-silver mines (fig. 5) were exploited at Thasos from the second half of the 6th to first half of the 5th century B.C. Although thermoluminescent analysis of ceramics gave the following datings: 14th-7th centuries B.C. and 3rd century B.C.-8th century A.D.[31], lead isotope studies of Thasian silver coins show that the main sources of metal for coinage were the mines of the island and the mines situated on the mainland opposite the island[32]. However the mines of Kenyra were exploited in the Classical period: most of the archaeological finds are dated to the second half of the 4th-early 3rd century B.C. (see below on p. 291); a fragment of an early 5th century B.C. Attic cup is considered to be evidence of late 6th-early 5th century B.C. mining[33]. Pottery finds of the same period, which are somewhat more numerous, come from a gold mine on the Acropolis of Thasos[34]. These finds thus confirm the evidence of Herodotus (VI. 47) about gold mining on the island and refute the view expressed early this century by P. Perdrizet that Herodotus had considerably exaggerated the income from gold mining both on the island and on the mainland, as if only alluvial gold had been worked there and there had been no mines, a significant output of metal could only have been achieved for short periods[35]. P. Perdrizet's hypothesis has been adopted in a commentary to Thucydides (I.100.2), which states that like Siphnos and Macedonia Thasos in the 4th century B.C. enjoyed only short periods of wealth from the exploitation of gold mines[36].

Numerous remains of mine working of the 5th-4th centuries B.C. have been unearthed at Laurion: mine galleries, areas for ore

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30 R.J. Forbes, 1950, 303.
31 A. Hauptmann et al., 1988, 109.
32 N.H. Gale et al., 1988.
33 C. Koukouli-Chrysanthaki, 1988, 174.
34 A. Müller, 1979; 1988, 193-195.
35 See: G. Weisgerber, 1988, 210; cf. P. Perdrizet, 1910.
36 A.W. Gomme, 1970, 295-296.

washing as well as workshops where various operations including preliminary ore processing and ore smelting were conducted (fig. 4)[37]. Archaeological data shows that mining activity ceased at Thorikos in 480-450 and 405-375 B.C., confirming the evidence of written sources[38]. The coast at Laurion is broken by various small bays, from which metal could have been brought to Athens, although there is no data to show whether this was the only or the major method for transporting metal[39].

As was stated above, the extraction of gold and silver on Siphnos flourished in the 6th century B.C., until the mines were exhausted in the last years of the century. Lead isotope analyses of silver coins of 550-485 B.C. from Siphnos and Aegina show that in this period the Siphnian mines were being worked, moreover that 18% of the Aeginetan coins analyzed were struck from Siphnian silver[40]. There are no evidence, however, about the exploitation of Siphnian mines in the Classical period. Regrettably, the authors of a monograph on mining on Siphnos, did not solve the question of why mining declined in ca. 500 B.C. As was stated in one of the reviews, the reason for this decay may have been the economic drawbacks of mining here especially in comparison to another deposits, such as those of Laurion; perhaps there was also a lack of fuel[41].

The gold field at Astyra near Abydus, mentioned by Strabo (XV.5.28), may have also been exploited in the Classical period. These mines were probably mentioned by Xenophon[42].

The extraction of lead, silver and tin continued in Iberia; some metals were certainly brought to the Western Mediterranean. Although we know of finds in mine galleries and at metalworking sites of Attic red-figured and black-glazed ware and lamps, which include items from the first half of the 5th century B.C.[43], the majority of these are materials dated to the last quarter of the 5th – first quarter of the 4th century B.C.[44]. In some cases, like with the mines of Huelva, there have also been finds of 5th century B.C.

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[37] S. Lauffer, 1979; 1980; H. Kalcyk, 1982, 99-109; 1983; E.J. Jones, 1982; 1984; 1985; 1988.
[38] H. Mussche, 1975, 54; *Thorikos and the Laurion*, 1975, 55-57.
[39] C.J.K. Cunningham, 1967, 145.
[40] E. Pernicka, G.A. Wagner, 1986, 210.
[41] C. Runnels, 1987, 340.
[42] J.M. Cook, 1973, 290, 366.
[43] C. Domergue, 1987, 10, 202-203, pl. XLIVb.
[44] C. Domergue, 1987, 8, fig. 38B; 13, 202-203; 1990, 168.

Phoenician amphoras[45], so that it is difficult to be certain whether there were direct contacts between Greece and the metal-producing centres of the Iberian peninsula in the Classical period.

On the whole, finds of Classical Greek pottery on the Iberian peninsula became more numerous for the 5th century B.C. in comparison to the previous century (24.0 and 2.3%) and reach a peak in the Late Classical period (72.2%). However, at Huelva they have a somewhat different pattern: 6th century: 10.5%, 5th century: 3.8% and 400-325 B.C.: 82.6%[46].

Copper mining on Cyprus persisted; this is proved by finds of Late Archaic-Early Hellenistic pottery on slag heaps. The epoch was characterized by the thriving of metalworking here[47]. C-14 analysis of charcoal from the mine at Kalavassos date this to the mid-5th century B.C.[48].

According to R.Pleiner, in the 5th century B.C. iron was mined in Boeotia and Sparta[49]. Significant deposits of iron ore were exploited between the Asopos and Boia on the coast of the Laconian gulf: this ore was transported to Boia, where considerable amounts of iron slag have been found near the ruins of the town. We have incomplete information about finds of iron slag and ore near Cape Thenaron in Porto Kaio and at Psammatus. Iron mines were also worked at this period in Euboea in the vicinity of Chalcis and Karistos. The mining and processing of iron ore may also have taken place on some of Cycladic Islands, including Andros and Keos. The Kiphnian mines are dated to the 5th-4th centuries B.C..

Two iron mines and five metalworking sites have been studied in Southern Laconia near the ancient Neapolis. Slag heaps date only to the Classical period. This is shown in particular by a homogeneity of the chemical and mineralogical composition of iron ore from different places and slags. The total volume of slag heaps in the area of ancient Neapolis is estimated at 2500 tons, and it is thought that ca. 700 tons of iron were smelted there[50].

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[45] C. Domergue, 1987, 206.

[46] P. Rouillard, 1991, 109-111, tab. 3; 117-126; H.-G. Niemeyer, 1992, 283, tab. 2.

[47] F.L. Koucky, 1982, 128.

[48] H.G. Buchholz, 1987, 173.

[49] R. Pleiner, 1969, 23-24.

[50] Y. Bassiakos, N.R.C. Demokritos, 1988. In the other article the output of pure iron from the Neapolis area workshops is estimated as 1200 tons at least. Although it is maintained the finds of numerous Classical sherds in stratigraphically undisturbed slag depositions, the authors tentatively associate the richness in

### *3.2.1. Metalworking Shops in the Light of Archaeological and Archaeometallurgical Studies*

The metalworking shops on the Athenian Agora were located in the Classical period along the western side of the Agora and in the industrial quarter to the south-west of it. The literary and epigraphical evidence of metalworking on the Athenian Agora is miserable. A fragmentary inscription of ca. 421-415 B.C. is preserved which mentions the purchase of copper, tin, lead, wood and charcoal for the casting of cult statues for the Hephaisteion (IG $I^2$, 370-371). Bronzeworking in the area of the Hephaisteion is mentioned in two passages (Andokides, De Mysteriis, 40; Bekker, Anecdota Graeca I, 316. 23)[51].

Archaeological materials, studied by C.C. Mattusch, prove that the remains of six workshops for casting both large-scale bronze sculptures and small objects, as well as iron smithies, belong to the period discussed[52]. The remains of one more workshop, which is provisionally dated to the 4th-1st century B.C., have been excavated fairly recently in the Agora[53]. In the area of the Athenian Kerameikos four pits were unearthed for casting 5th-century B.C. statues[54]. The remains of 4th-century B.C. bronze sculpture production come from the southern slope of the Athenian Acropolis (the so-called eastern casting pit)[55]. One cannot exclude the possibility that the western casting pit may even be dated to the 5th century B.C. and was intended for the casting of the statue of Athena Promachos[56]. We know of clay moulds and impressions revealing the activity of toreuts, including a fragmentary matrix impression for stamping reliefs for cuirasses, which dates to the period of the Peloponnesian War[57].

In 1956 in Olympia a bronze-working shop was unearthed of Phidias (fig. 26, 1)[58], built either as was thought earlier for the construction of a chryselephantine statue of Zeus, or for some

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metal of the area with the 6th century B.C. Spartan occupation. See: J.E. Bassiakos, C.T. Michael, D. Chaikalis, 1989, 258.

51 C.C. Mattusch, 1977, 341.

52 C.C. Mattusch, 1977, 348-359; 1988, 220, 222-224, 227; 1989; G. Zimmer, 1990, 60-62; 75-76; 78-83.

53 N.A. Winter, 1984, 57.

54 G. Zimmer, 1984; 1990, 34-38; C.C. Mattusch, 1988, 228.

55 C.C. Mattusch, 1988, 227-228; G. Zimmer, 1990, 76-78.

56 See: G. Zimmer, 1990, 62-71.

57 W.-D. Heilmeyer, 1986, 111-112, Abb. 17.

58 A. Mallwitz, W. Schiering, 1964; C.C. Mattusch, 1988, 226-227, 231-232.

other, probably female, sculpture, as W. Shiering has assumed[59]. In 1982, under Phidias' workshop, were unearthed casting pits dated to 440-430 B.C.[60]. Bronze slag and fragments of furnace walls were found in the filling of a 4th century B.C. well near to the Stadion. We also know of separate finds of unfinished casts, moulds, and crucibles dating to the 5th-4th century B.C.[61].

In the area of the southern Stoa of the Corinthian Agora a 4th-century B.C. casting pit has been unearthed[62].

In Isthmia at the sanctuary of Poseidon in a mixed layer of the 7th- mid-5th century B.C. iron slag was found, which, in the publisher's opinion, proves that iron was smelted from ore at the sanctuary or nearby[63]. This publication opened up a discussion: E.R. Clough thinks that the materials from Isthmia cannot prove that iron was smelting from ore, because no remains of furnaces have been excavated there, whereas the results of analytical studies of slag cannot be taken into consideration[64]. The members of an archaeometallurgical group from the University of Aston at Birmingham offer another interpretation of the materials published by the American scholars: they consider the slag found in Isthmia derives from metalworking rather than metallurgy, and demonstrates the presence of local iron smithing[65]. Bronze ingots found in the same layer could, according to laboratory studies, have been waste from both metalworking and metallurgy, in the latter case inferring that ore minerals and cassiterite were being smelted[66].

The excavations at the Samian Heraion revealed a hoard of hand-made clay crucibles for melting bronze in a layer with Late Classical pottery[67].

Work during 1973 at the palace of Demetrias in Thessaly in the area of a peristyle court unearthed two furnaces for smelting bronze, as well as fragments of casting moulds. The exact date of

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59 W. Schiering, 1988; 1991, 130 ff.; cf. C. Rolley, 1993, 388-389.

60 G. Schneider, G. Zimmer, 1984; W.-D. Heilmeyer, 1986, 115-118; W.-D. Heilmeyer, G. Zimmer, G. Schneider, 1987; G. Schneider, 1989; 1989a; G. Zimmer, 1990, 39-50.

61 W.-D. Heilmeyer, 1969, 9-10, 15, 18-19; G. Zimmer, 1990, 57-60.

62 G. Zimmer, 1990, 82.

63 W. Rostoker, E.R. Gebhard, 1981, 41-44.

64 E.R. Clough, 1982.

65 S. Fells et al., 1982.

66 W. Rostoker, E.R. Gebhard, 1979; W. Rostoker et al., 1983; G. Zimmer, 1990, 74-75.

67 H. Kyrieleis, 1980, 339-340, Abb. 5.

these remains is unknown, however, the *terminus ante quem*—the destruction of the palace—is the late 4th century B.C.[68].

In Nemea the remains were excavated of a bronzeworking shop dated to the second half of the 5th century B.C. and situated approximately 70 m from the temple of Zeus (fig. 26, 2)[69].

In Olynthus bronze and lead ingots were found which may indicate local production[70].

In the central district of Heraclea in Lucania houses were unearthed with furnaces for firing pottery and smelting metal, which were datable to the 4th century B.C. onwards. This district is large[71].

Excavations at the site of Roccagloriosa, also in Lucania, have revealed an extra-mural neighbourhood dated to the 4th century B.C., ca. 1000 sq. m. in area with much evidence of the activities of potters and metalworkers[72].

Turning our attention to the Pontic region, I shall mention the remains of a 5th-century B.C. workshop with two bronze-smelting furnaces found in Mesembria, perhaps in the region of the Temenos[73].

Excavations in the neighbourhood of the Second Temenos of Olbia revealed a bronzeworking shop with furnaces, dating to the 5th century B.C. Also found were moulds for casting ornaments[74]. A matrix for stamping plaques in the so-called "animal style" comes from the Kosharskoe settlement[75]. In Pantikapaion were found the remains of an ironworking shop of the 5th century B.C., a 4th-century B.C. smithy, debris of a metalworking shop of the first-second third of the 4th century B.C. and the remains of statue casting, dating to the second half of the 4th century B.C.[76]. In Mirmekion iron slag was found in a layer from the second quarter of the 5th century B.C. (Yu.A. Vinogradov's communication).

In the 5th-4th century B.C. toreutic workshops appeared in

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[68] J.-P. Michaud, 1974, 660-661, fig. 194; see also more detailed plan with the designation of the furnaces: G. Touchais, 1980, 638, fig. 121.

[69] S. Miller, 1977, 19-20, fig. 5, pls. 12-13; G. Zimmer, 1990, 50-57.

[70] D.M. Robinson, 1941, 477-481, pls.CLVII-CLVIII.

[71] B. D'Agostino, 1973, 230; D. Adamesteanu, 1974, 100 ff.; M. Frederiksen, 1977, 57-58.

[72] M. Gaultieri, 1993, 335-336, fig. 202.

[73] L. Ognenova, 1973.

[74] N.O. Lejpun'ska, 1984; S.D. Kryzhitskij, 1985, 83, fig. 23, XV.

[75] E.A. Levina, 1989; M.Yu. Treister, in print.

[76] M.Yu. Treister, 1984; 1987a; 1987b; 1992a, 72-83.

Scythia and Thrace, to judge by finds of a bronze matrix in Garchinovo[77] and of stamps for hammering plaques at the Kamenskoe and Bel'skoe fortified settlements and in the Kuban basin[78].

One should remember hoards, which may have belonged to jewellers. One of them from the region of Sinope consisted of more than one hundred silver coins and their fragments, among which the coins of Athens predominated, Sinopean and Persian sigloi (as well individual coins from Sicily, Macedonia and Thrace); more than three hundred silver ingots and their fragments, parts of ornaments and vessels, as well as silver gilt rhyta in the shapes of a deer head and a double-sided female head. The hoard is dated by the coins to the late 5th century B.C., whereas the rhyton in the shape of the deer head is dated to the 5th century B.C. and the other vessel to the 4th century B.C.[79].

A second hoard comes from Syria and is dated to ca. 480 B.C. It includes silver coins and fragments of Aeginetan, Thasian, Samian, Attic origin, coins of the Thraco-Macedonian tribes, 50 ingots and their fragments, and three broken ornaments[80].

Finds of such 5th-century B.C. hoards are not rare in the Near East. C. Kraay and P. Moorey published two similar hoards from Syria. The first of them, consisting of 113 coins and parts of coins of Sicilian, Macedonian, Thracian, Attic, Aeginetan, Corinthian, Cypriot, Phoenician, and Persian mintage, 10 ingots and items of jewelry—mainly pendants and earrings of Achaemenid types—was found on the Jordanian-Syrian border in the region of Hauran in 1967. There was a predominance of coins from four areas: Athens (310), Cyprus (21), north-west Asia Minor (15) and the Northern Balkans (13). The hoard is dated to ca. 445 B.C.[81].

A hoard from Massiaf in Syria found in 1961 consisted of 100 coins and coin fragments among which those of Athens (35), Aegina (11), and Phoenicia (16) predominated; also found were earrings of Achaemenid types. The hoard was dated by its publish-

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77 S. Kołkowna, 1980, 130, pl. IX, 1 with references; A.P. Mantsevich, 1980, 102-103.

78 B.A. Shramko, 1970; 1987, 121; A. Leskov, 1990, Kat. 131-132, Abb. 92-95; M.Yu. Treister, 1989; 1990, notes 44-46.

79 C.M. Kraay, P.R.S. Moorey, 1981; M. Pfrommer, 1983, 274; 1990a, 193, 197, 201, Anm. 14, 44, 48, 68; 1993a, 343, Anm. 29; *Hommes et Dieux de la Grèce antique*, 1982, N 110; *The George Ortiz Collection*, 1993, N 152-154, 205, 206.

80 *Gienava* XXX (1982), 208-209.

81 C.M. Kraay, P.R.S. Moorey, 1968, 181-210.

ers to ca. 425-400 B.C., although Phoenician coins allow us to put it in the first quarter of the 4th century B.C.[82].

We also know of a hoard of similar composition of the last quarter of the 5th century B.C. from Malaer in Western Persia[83].

Two hoards come from Egypt. One found in Bena mainly includes coins minted in the Thraco-Macedonian region and is dated to ca. 485 B.C. A hoard from Zagazig is close in date to the hoard from the border of Syria and Jordan[84].

*3.2.1.1. Metalworking Shops in Town Structures*

Clearly Greeks of the Classical period would have been well aware of the dangers of concentrating in towns crafts with fire risks especially those crafts connected with metalworking. However, the study of the town plans and of materials from excavations shows that in this period the political ambitions of the democratic states played in most cases a more important role than did purely utilitarian considerations. The limitations resulting from this approach only becamer clear considerably later, although the need for for pragmatism should have been realized much earlier[85].

The following example mentioned by E.-L.Schwandner is typical. Kassope was established and planned according to the system of Hippodamos in ca. 360 B.C. (fig. 27). In the 4th century B.C. living quarters and a bronzeworkshop were located in house 8; in the following century it contained a *balaneion*; in house 5 in the 4th century there were only living rooms without workshops. In the 3rd century a pottery workshop and a smithy were established here, whilst in the following century there were no more workshops here, but only living quarters. These changes clearly show that house 5 in Kassope was situated in a good residential area, although there was no prohibition against establishing workshops with fire risks here.

Schwandner suggests that already in the Classical period the freedom to conduct business activities within town walls was accorded more importance than economic planning. Therefore in those towns built according to a given plan, there were no indus-

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[82] C.M. Kraay, P.R.S. Moorey, 1968, 210-222; cf. A. Destrooper-Georgiades, 1987, 350.

[83] C.M. Kraay, P.R.S. Moorey, 1968, 221-226.

[84] C.M. Kraay, P.R.S. Moorey, 1968, 226.

[85] E.-L. Schwandner, 1988.

trial zones. "*Industrielle Viertel*" or "*spezialisierte Handwerkviertel*" could only be established in the case of interregional manufacture, where a considerable proportion of the citizenry were engaged in the production of a certain category of items. Such industrial zones had already been established in the Archaic period for the manufacture of ceramics in developing cities like Athens and Corinth; however, this was typical neither of colonies nor of the *synoikismos* of the Classical era[86].

However excavations of craft districts of the 4th century B.C. at Heraclea and Rocca gloriosa in Lucania, which have revealed numerous vestiges of the manufacture of pottery and iron[87], suggest that such industrial areas, even outside city walls as at Roccagloriosa, need not in fact only exist in centres with an interregional importance. In this connection, one should remember that in Plato's ideal city of Magnesia artisans and citizens lived in their own districts (Plato.Laws 8.848e 5-7)[88].

In most Classical Greek cities workshops and shops were located on the main streets, although in the course of time the demand for them grew and they were also founded in districts along side streets. The example of Olynthus shows that in the planning of typical 5th century B.C. buildings the increasing need for workshops and shops had not been foreseen. The workshops were enlarged by reducing living space (house A VII 8). An analysis of planning structures supports the view that leased workshops existed (houses A VI 8; A IV 9): the owner of house A VI 8 had originally enlarged the workshop area and then having decided to rent it, built a new workshop in the a courtyard (figs. 28-29)[89]. It is worth noting that a lead ingot was found in one of the rooms of house A IV 9[90].

An important factor in deciding where to site temporary workshops was the patron for whom the craftsmen, e.g. bronze-founders, were working. For example, in case of the workshop of Phidias at Olympia (fig. 26, 1) or the workshop at Nemea (fig. 26, 2), which were both located in buildings near to temples, one might suggest that the site for the workshops was made available by temple administrators. When orders were placed by *poleis*, the

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86 E.-L. Schwandner, 1988, 184-185; W. Hoepfner, E.-L. Schwandner, 1994, 330.

87 See, e.g. M. Gualtieri, 1993, 335-336.

88 I. Morris, 1991, 39.

89 W. Hoepfner, E.-L. Schwandner, 1994, 112, Abb. 89.

90 D.M. Robinson, 1941, 478, N 2518.

*epistatai* were responsible for finding a location for the workshop. This occurred in case of the founder's workshop on the Temenos of the Hephaisteion.

However, sometimes the bronzefounder himself chose his workplace. That was probably the case with the 5th-century B.C. casting pit in the Kerameikos, which is situated right by the city wall[91].

One can get an idea of the dimensions of Classical workshops, for example, on the basis of excavations at Nemea. There, in the third quarter of the 5th century B.C., a sculptor occupied *oikos* 8 and 9 near the sanctuary of Zeus. *Oikos* 8 has an almost square groundplan (11.55 × 11.95 m). It was rebuilt perhaps because it was re-used as a bronzeworking shop. The western part of *oikos* 9, with dimensions 11.20 × 14.50 m., was also occupied by a workshop. Both buildings were fell into ruin in the late 5th century B.C. as did the sanctuary (fig. 26, 2)[92].

This workshop thus occupied a building which had originally had other functions, it existed for a fairly short period of time and was located next to a sanctuary. There every reason to see it as the temporary workshop of a sculptor, who had been working on a specific order. Another example, which gives a good idea of the dimensions of a bronzeworking shop, is the workshop of Phidias at Olympia. A mud-brick podium and two casting pits occupy the central part of a rectangular construction 32 × 14.5 m (fig. 26, 1). This area was sufficient to accommodate all phases of production from the making of a mould for casting to the coldworking of the statue[93]. It has been conjectured that the internal dimensions of these workshops were derived from the dimensions of the cella of the temple of Zeus[94].

The Acropolis of Athens and its slope housed in the period 470-440 B.C. four large workshops with dimensions of ca. 40 × 15, 40 × 23 m etc. G. Zimmer has maintained that these workshops though originally built for the casting of large-scale bronze statues were constructed with a view to possibilities for future use and that most of the workshops on the Acropolis were indeed used over a long period of time. Furthermore another consideration in

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[91] G. Zimmer, 1990, 158.
[92] *Nemea*, 1989, 161-167; G. Zimmer, 1990, 50-57.
[93] G. Zimmer, 1990, 165.
[94] J. de Waele, 1988.

building such large and permanent workshops was that they should be accesible to at least a limited group of citizens[95].

### *3.2.2. Workshops in the Light of the Stylistic Analysis of Metal Objects*

The set of articles produced in Classical Greek workshops underwent change. The casting of statuettes considerably decreased, as the practice of offering them virtually ceased after 450 B.C. (numbers of Classical bronze statuettes are only about 10% of the numbers Archaic statuettes in the biggest collections). At the same time the casting of life-size bronze statuary was far commoner than in the previous period. Usually bronze vessels and mirrors were manufactured; the technology used in their manufacture encouraged mass production. From the mid-5th century B.C. local styles had disappeared practically everywhere except in the output of certain workshops, which preserved some traditions, for example in Arcadia or in Magna Graecia[96]. Even in the Early Classical period the demarcation of local schools is extremely difficult. For instance, mirrors with caryatid handles, whose manufacture reached its peak between 480 and 450 B.C. (comprising about half of all such mirrors), are conventionally divided into items in the "Argive", "Sicyonian", "Corinthian", "Argo-Corinthian" styles, which combined elements typical of all these different schools (fig. 30)[97]. The stylistic groups of mirror supports—conventionally distinguished by R. Tölle-Kastenbein as "Corinthian" and "Sicyonian"—are so close to each other that they form a single set of objects, although Corinth perhaps was the home of these stylistic trends[98]. Commonly, various opinions have been held about the attribution of bronze vessels, mirrors and other metal objects from the Classical period. For instance, C. Rolley holds that the attempt to attribute 4th-century B.C. bronze mirrors and hydriai to Chalcis, Athens and Corinth is, in effect, an attempt to localize products that were created by a specialized class of craftsmen, whose members were linked by a system of production and distri-

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[95] G. Zimmer, 1993. See also: W. Shiering, 1991, 143-145.

[96] J. Charbonneaux, 1962, 112-115; C. Rolley, 1986a, 169; B. Barr-Sharrar, 1990, 215-216; R. Thomas, 1992, 36-37.

[97] L.O.K. Congdon, 1981, 106.

[98] R. Tölle-Kastenbein, 1980, 134.

bution which covered the whole Greek world. Exports reached barbarians (Thracians and Scythians), who either imported finished objects or used items made locally by Greek craftsmen. One should thus be very careful when interpreting both distribution maps and the influence of large-scale sculptures in small plastics, because motifs, moulds and casts were distributed on a much more highly organized basis than ever before.

For the period of "Severe Style" one can generally distinguish two main trends in styles: one developed in Argos or in the Northern Peloponnese and the other, the South-Eastern, was influenced primarily by Sparta. The small plastics of Magna Graecia differed from those of mainland Greece by their use of Sub-Archaic forms and motifs[99].

In Classical jewelry local styles have been attributed to separate regions: Northern Greece, Southern Italy, Cyprus, and the Northern Pontic area. The output of the workshops of Greece proper and of the islands are too homogenous to permit the identification of local schools[100].

## The Peloponnese

### Argos

Several so-called "Argive prize hydrias" dated to 470s-460s B.C., decorated with protomes and the busts of peplophores, have been fairly reliably identified as being of Argive manufacture on the basis of inscriptions. There are also some vessels which are stylistically similar to these[101] and five mirror supports in the Severe Style[102].

The works of the Argive sculptor Polyclitus influenced athlete statuettes from the second half of the 5th century B.C. onwards—not only in the Peloponnese but in Ionia and Cyprus as well[103]. A statuette of Apollo Bearn in the Ortiz collection with the dedicatory inscription to Artemis is said to be the work of an Argive craftsmen[104].

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[99] C. Rolley, 1986a, 170, 176, 178; R. Thomas, 1992, 77-80, 99, 101.

[100] R. Higgins, 1980, 123.

[101] E. Diehl, 1964; R. Tölle-Kastenbein, 1980, 141; P. Amandry, 1980, 211-217.

[102] R. Tölle-Kastenbein, 1980, 142-146; C. Rolley, 1986a, 97.

[103] See, e.g. C. Rolley, 1986a, 164-166; A. Leibundgut, 1990; R. Thomas, 1992, 104 ff.

[104] *The George Ortiz Collection*, 1993, N 142; A.E. Raubitscheck, 1992, 171 with references.

## Laconia

R. Tölle-Kastenbein attributes to a Spartan workshop 8 statuettes in the Severe Style, particularly those which represent Athena in a chiton with a gorgoneion, most of which were found at the sanctuary of Athena Chalkioikos on the Acropolis of Sparta. Stylistically they form a rather isolated group. The number of craftsmen in Sparta was perhaps decreasing following the Persian Wars, although Spartan votives are unknown in sanctuaries outside Laconia[105].

## Corinth

It was perhaps in an Early Classical workshop at Corinth that 6 bronze figures and the ornaments for mirror supports were cast. R. Tölle-Kastenbein gives the different technical means used to manufacture them. She thinks that in the era of the Severe Style bronzecasting was much more developed at Corinth than was the production of terracottas and sculptures[106].

R. Thomas maintains that the proportions and stylistic features of these figures betray Southern Peloponnesian and Spartan influence, and explain this phenomenon by the political orientation of Corinth towards Sparta between 560 and 500 B.C.[107]. A group of bronze athlete figures has been attributed to a Corinthian workshop of ca. 440 B.C.[108].

The study of bronze prochoi has shown that there was a considerably smaller variety of production in the Classical period; at that time these vessels were only manufactured at the workshops of Corinth. Of 47 prochoi included in I.-K. Vokotopoulou's catalogue the provenance of 39 pieces is known, more than a half of which (20) were found in Dodona; a considerable number of finds comes from Perachora (8) and Carthage (5)[109]. A series of bronze hydriai and calpides, in particular the so-called Patras group of hydriai, which is dated to the second half of the 5th-4th century B.C.[110], and mirrors with engraved lids and profiled heads in relief on their lids, dated to the 4th century B.C.[111], belong to

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[105] R. Tölle-Kastenbein, 1980, 161-166.
[106] R. Tölle-Kastenbein, 1980, 132.
[107] R. Thomas, 1981, 154ff.; 1992, 99.
[108] C. Rolley, 1986a, 102-103.
[109] I.-K. Vokotopoulou, 1975, 169-170.
[110] W. Züchner, 1942, 175-196; E. Diehl, 1964, 43-45, N B 206-216.
[111] W. Züchner, 1942, 196-205; C. Rolley, 1986a, 176.

the output of a Corinthian or Northern Peloponnesian workshop. However, some of these mirrors with relief heads on their lids have been recently attributed to a workshop situated in Eastern Locris[112].

Clay moulds made from metal objects found during excavations at Corinth have been dated to the early 5th – late 4th centuries B.C. All of them were used in casting sculptured decorations for metal ware[113]. This fact shows that Corinthian workshops were specialized in the manufacture of artistic metal vessels. In Corinth—in contrast to neighbouring Argos, Sicyon or Aegina—there had never been a prominent local school of bronze sculpture; when necessary such work was undertaken by specially invited craftsmen[114].

The literary evidence preserves numerous reports of a specific Corinthian type of bronze, which contained silver or gold or both and was more valuable than silver and almost as valuable as gold (see, e.g. Pliny. N.H. XXXIV.6; Cicero. Verr. II.2.46, 83, 176; II.4.1, 51, 98, 131; Suet. Aug. 70.2; Tib. 34.1).

The reason that this most precious alloy was named after Corinth may have been the reputation of the city—until its sack in 146 B.C. by the Romans—as one of the leading centres for the manufacture of bronze[115]. In spite of the view held some modern scholars, who have suggested that Corinthian bronze was simply bronze from Corinth, it has been proved experimentally that the manufacture of depletion-gilded copper-silver-gold alloy is possible[116]. More complex is the problem of when Corinthian bronze was used. For example, D.M. Jacobson and M.P. Weitzman maintain that the heyday of Corinthian bronze lasted only from Cicero's day to roughly the end of the 1st century A.D.[117]. A.R. Giumlia-Mair and P.T. Craddock hold that artificially coloured Corinthian bronze goes back to Egyptian "black copper" which was already being produced in the mid-2nd millennium B.C. and maintain that workshop manufacturing such an alloy was established in Corinth at least 200 years before the Roman siege, this

[112] A. Onassoglou, 1988, 451-456.
[113] E. Pemberton, 1981, 105-108.
[114] E. Pemberton, 1981, 110.
[115] See, e.g. H. Payne, 1931, 349-350 and most recently: D.M. Jacobson, M.P. Weitzman, 1992; D. Haynes, 1992, 85-86; A.R. Giumlia-Mair, P.T. Craddock, 1993.
[116] D.M. Jacobson, M.P. Weitzman, 1992, 244-245.
[117] D.M. Jacobson, M.P. Weitzman, 1992, 246.

being proved by the earliest testimonia which dated to the mid-4th century B.C. (Athen. Deipn., IV.128D, V.199E; VI.236B)[118].

Arcadia

W. Lamb attributed 5 bronze figures of peplophores in the Severe Style to an Arcadian workshop. Half a century later the number of analogous statuettes and mirror supports had increased to 29, although localizing the workshop in Arcadia is, according to R. Tölle-Kastenbein, still under question. At least six stylistic groups have been distinguished, which may be part of the production of workshops in Arcadia and Achaia, which employed provincial craftsmen of a mediocre artistic quality. In her opinion, there is no trace of the influence of the leading artistic centres of Greece nor of the Peloponnese[119].

However R. Thomas, who holds that there is a clear difference between North- and South-Arcadian statuettes, maintains that the first group originating from Lusoi, Mt. Lykeion and Mantineia demonstrates a clear Argive influence, whereas statuettes found mainly in Tegea were produced under a strong Laconian influence[120].

Central Greece

Attica

Some bronze hydriai[121], calpides[122], and "*Griffphialen*", dated to 480-450 B.C.,[123] as well as form 2 of 5th-4th century B.C. bronze oinochoai—the so-called "*Kleeblattkannen*"[124]—have been attributed to Athenian workshops.

Among items of bronze sculpture a head of a youth from the Athenian Acropolis of ca. 470 B.C. is probably of Attic workmanship[125], although it has also been suggested that it was manufactured in a workshop in the North-Western Peloponnese, to be

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118 A.R. Giumlia-Mair, P.T. Craddock, 1993, 14-18, 23, 26.

119 R. Tölle-Kastenbein, 1980, 159-160.

120 R. Thomas, 1992a, 99-100.

121 E. Diehl, 1964, 30, N B 105a (ca. 450 B.C.). C. Rolley considers that only a small part of known hydriai dated 460-400 B.C. may have been produced in Attic workshops. See: C. Rolley, 1986a, 174-175.

122 E. Diehl, 1964, 38, N B 149-150 (ca. 440 B.C.).

123 U. Jantzen, 1958, 13 f.; R. Tölle-Kastenbein, 1980, 62.

124 T. Weber, 1983, 144-145.

125 B.S. Ridgway, 1970, 41. N 11; C.C. Mattusch, 1988, 95.

specific at Argos[126]. A bronze gilt head, which perhaps belonged to a statue of Nike—the so-called "Golden Nike"—known from records of temple inventory, has been dated to ca. 420 B.C.[127].

A series of bronze statuettes of Athena Promachos, bronze kuroi, and mirror supports has been ascribed to Attic production[128]. Stylistic analysis of bronze figures of Athena Promachos have allowed H.-G. Niemeyer to distribute them between five Attic workshops[129]. R. Tölle-Kastenbein considers that not all of these workshops were located in Athens, however a considerable number of Athena Promachos statuettes of obviously Athenian workmanship provide a broad basis for differentiating Athenian bronzeworking shops of the Late Archaic-Early Classical periods[130]. At the same time, C. Rolley considers that the "Attic" group of bronzes attributed by R. Tölle-Kastenbein is too distorted by Corinthian and Argive pieces[131]. R. Thomas believes in the influence of a Peloponnesian style[132].

The activity of Athenian workshops that manufactured bronze statuettes can be traced down to the mid-5th century B.C.[133]. Bronze phialai with handles which were common at the turn of the 6th and 5th centuries B.C., became extremely rare in the second quarter of the 5th century B.C. By contrast, stylistically contemporary mirror supports were in wide circulation at that time, although they were practically unknown earlier. The chronological changes of two different but stylistically similar categories of bronze objects demonstrates, according to R. Tölle-Kastenbein, a change of craftsmen in Athenian bronze workshops[134]. Artistic bronzeworking in Athens in the period under discussion is also confirmed by finds of clay moulds taken from metalwork[135].

Bronze mirrors with handles were also produced in Attic workshops[136]. Analyzing Classical bronze mirrors with lids, W. Züchner has stated that only one piece can be attributed to an Attic work-

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[126] C. Rolley, 1986a, 238, N 239.
[127] B.S. Ridgway, 1981, 123-124, N 2; C.C. Mattusch, 1988, 172-175.
[128] R. Tölle-Kastenbein, 1980, 17-75; L.O.K. Congdon, 1981.
[129] H.G. Niemeyer, 1960, 37-55.
[130] R. Tölle-Kastenbein, 1980, 70-71.
[131] C. Rolley, 1986, 384.
[132] R. Thomas, 1992, 100.
[133] C. Rolley, 1986a, 114-115.
[134] R. Tölle-Kastenbein, 1980, 71.
[135] E.R. Williams, 1976; W.-D. Heilmeyer, 1986, 111-112; A. Pariente, 1990, 706-707, fig. 4.
[136] S. Papaspyridi-Karazou, 1951, 585; Z.A. Bilimovich, 1973.

shop. The scarcity of materials, characteristic of the work of Attic toreuts and bronzeworkers, was explained by the fact that a leading role was played by silver-smiths, although Attic craftsmen may have copied imported articles in bronze[137]. Undoubtedly, workshops producing silverware existed in Classical Athens[138]. An analysis of a graffito on a silver jug from Dalboki in Thrace probably shows that such vessels were specially produced in series for export[139]. It is no accident that most finds of silver ware attributed to Attic workshops come from tumuli of the Kuban and Dnieper basins and Thrace[140].

## Aegina

The existence of a local metalworking school in Aegina is attested to by Pausanius (VIII. 53. 11). Here was invented a special alloy recipe, Aeginetan bronze, which, as Pliny mentioned, was especially good for casting the upper parts of candelabra. It is known that some sculptors like Myron preferred this alloy; Kanachos had cast a statue of Apollo Philesios in Didyms (N.H. XXXIV. 8, 10-11, 75)[141]. The bronze head of a bearded warrior from the Athenian Acropolis was probably cast by Aeginetan craftsman in ca. 500-480 B.C.[142].

The Aeginetan school of bronze sculpture flourished in the second quarter of the 5th century B.C. The attribution of the following pieces to this school is more or less certain: the Charioteer from Delphi, the Zeus from Cape Artemision[143], the Riace warriors, and a fragmentary statue of a horseman from Southern Italy[144]. However, there is a striking variety in the attributions of the above-mentioned pieces by different scholars: for example, the Charioteer from Delphi was also thought to be of Attic workmanship (perhaps, the workshop of Kritios or Kalamis), Boeotian (the sculptor Sotades of Thespiai), Southern Italian or Sicilian (e.g. Pythagoras of Rhegium)[145].

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[137] W. Züchner, 1942, 221-223.
[138] K. Schefold, 1931; X.S. Gorbunova, 1971.
[139] D.W.J. Gill, 1987, 51.
[140] Z.H. Szymanska, 1984, 106-108.
[141] C.C. Mattusch, 1988, 89-90; D. Haynes, 1992, 84.
[142] C.C. Mattusch, 1988, 91-94.
[143] B.S. Ridgway, 1970, 62-64.
[144] See: D. Williams, 1989, 550-551.
[145] C.C. Mattusch, 1988, 131.

### Euboea

A group of bronze peplophore statuettes in the Severe Style has been attributed to an Euboean workshop[146].

W. Züchner considered a series of lid-mirrors to be of Chalcidian manufacture, on the basis of a find of five mirrors of the late 5th-mid-4th century B.C. in the necropolis of Eretria, which form a single group from the point of view of their technical details and are stylistically similar to the subjects of Chalcidian coinage[147]. There were possibly toreutic workshops here: in inventories of the Parthenon there is mention of a silver Chalcidian bowl (*poteria xalkidika argyra*)[148].

### Boeotia

A group of bronze calpides with handle attachments in the shape of sirens, dating to the second quarter of the 5th century B.C., were most probably manufactured in workshops in Boeotia[149]. The statue of Poseidon found in the bay of Livadostro is to judge by a dedication on its bronze plinth the work of a Boeotian sculptor of ca. 480 B.C., although other opinions have been expressed (Aegina, Sicyon)[150]. Boeotian small plastics of the Severe style show features of Attic and Ionian styles[151].

### Northern Greece

### Thessaly

About ten bronze statuettes and ornaments of utensils which do not form a single group stylistically have been attributed to Thessalian workshops of 480-450 B.C. These objects may have been manufactured in workshops situated in different regions in Thessaly[152].

### Macedonia

Northern Greece housed one of the most important centres for toreutics of the 4th century B.C. Here were produced items of

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[146] R. Tölle-Kastenbein, 1980, 82.
[147] W. Züchner, 1942, 159-174; C. Rolley, 1986a, 176.
[148] W. Züchner, 1942, 161.
[149] E. Diehl, 1964, 38, N B 151-155.
[150] B.S. Ridgway, 1970, 40, N 9; C.C. Mattusch, 1988, 79-82.
[151] R. Thomas, 1992, 100-101.
[152] R. Tölle-Kastenbein, 1980, 119-122.

jewelry and vessels made of gold and silver[153]. It has proved more to locate ateliers; were they situated only in Macedonia, from where significant quantities of their products were distributed to neighbouring Thessaly[154], or did a Thessalian toreutic centre exist as well[155]? In any case it is obvious that the aristocracies and royal courts of Thessaly[156] and Macedonia attracted metalworkers, who made masterpieces like the krater from the burial at Derveni (see below on p. 301). It has also been maintained that some of the earrings dating from the first half of the 4th century B.C. found in the Central Balkan area were made locally by experienced itinerant artisans from Macedonia[157].

The Macedonian workshop may already have existed as early as the reign of Archaelaus, who summoned Euripides and Zeuxis to his court[158]. The influence of both Attic and Achaemenid toreutics is evident is the development of the 5th-4th century B.C. Macedonian school of toreutics[159].

A Northern Greek workshop, situated perhaps in a Chalcidian colony, manufactured the so-called Chalcidian helmets of type 2, finds of which come mainly from Macedonia[160].

### Asia Minor and Thrace

W. Züchner singled out an Ionian workshop which manufactured mirrors with lids: four out of the five pieces attributed to the group originate from the Northern Pontic area; only two of these are dated to the third quarter of the 4th century B.C., while the others are dated to the Early Hellenistic period. Züchner hesitated in locating the workshop, although Northern Ionia is probably to be excluded[161].

Greek workshops in the Achaemenid satrapies of Asia Minor worked in the so-called "Greco-Persian" style, using shapes charac-

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[153] M. Pfrommer, 1982; 1983; Z.H. Archibald, 1985; D. Musti et al., 1992, 48-59. R.A. Higgins (1982, 142) associates the appearance of the Macedonian jewelry in the second-third quarter of the 4th century with the exploitation of gold mines by Philip II.

[154] S. Miller, 1979, 49-51.

[155] A. Onassoglou, 1988, 456.

[156] E. Frolov, 1972, 70 ff.; 1990, 36 ff.

[157] R. Vasić, 1990.

[158] B. Barr-Sharrar, 1984, 10, note 4; 1986, 72, note 3; C. Rolley, 1986a, 178-184, 192.

[159] B. Barr-Sharrar, 1984; 1986. See, e.g. also *Makedonen*, 1994, N 247-249.

[160] H. Pflug, 1988c, 140-141.

[161] W. Züchner, 1942, 216.

teristic of Achaemenid art, however introducing a certain ornamental element. This is true, for instance, for the bracelets with two heads on their ends, which were produced from at least the late 5th century B.C.[162].

In the 5th-4th century B.C. metalware was manufactured in the workshops of Asia Minor. For example, a silver amphora-rhyton found in Kukova Mogila near Duvanly has been attributed to a workshop in Asia Minor of the first half of the 5th century B.C. and a jug found in Rosovets was fashioned in the early 4th century B.C. in a workshop situated somewhere in the north of the Aegean Sea or on the coast of Asia Minor[163].

M. Pfrommer identifies an amphora-rhyton from the Malibu collection, whose form and decoration combine Greek, Achaemenid and Egyptian stylistic elements, as the work of a workshop from Northern Asia Minor under Achaemenid influence and established in the late 5th or early 4th century B.C. probably at one of the satrap's courts[164].

A hoard found near Sinope[165] demonstrates that the workshops for the production of goods in precious metals in the "Greco-Persian" style were also situated on the southern coast of the Black Sea.

A bronze oinochoe with an attachment, in the form of a head of Dionysus, dated to the mid-4th century B.C., and found at Kirklareli was probably manufactured at one of the Greek centres on the Hellespont[166].

## Egypt

If one follows the view of C. Reinsberg who maintained on the basis of a hypothesis that plaster casts were made in the process of manufacturing relief utensils—see a critique by F. Burkhalter be-

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[162] M. Pfrommer, 1990, 100-103.

[163] H. Luschey, 1983, 315 f.; Z.H. Szymanska, 1984, 108-109; P. Zazoff, C. Hocker, L. Schneider, 1985, 599; C. Ewigleben, 1989, 26; D. Musti et al., 1992, 41-42. See about rhyton from Kukova Mogila also Pfrommer, 1990a, 193: "Angesichts der nordkleinasiatischen und kappadokischen Parallelen muss man bei dem Exemplar von Kukova Mogila auf eine kleinasiatische Werkstatt schliessen, die man unter Umstanden im Umfeld eines Satrapenhofes suchen wird".

[164] M. Pfrommer, 1990a. Satrapal manufacturing centres clearly existed also in Egypt, in Lydia and in Syria. Presumably these metalworkers were local (see: G.R. Tsetskhladze, 1994b, 99).

[165] *The George Ortiz Collection*, 1993, N 152-154, 206; see also: M. Pfrommer, 1983, 274, Anm. 190; 1990a, 193, 197, 201; 1993, 343, Anm. 29.

[166] M. Pfrommer, 1993a, 347-349, Taf. 39, 1-3.

low on p. 238, 315—that there was a permanent toreutic workshop at Memphis, then a workshop of Greek craftsmen, who had perhaps originated from Naucratis, had already been established in the late 5th century B.C. The three earliest plaster casts are dated to between the third quarter of the 5th and the first quarter of the 4th century B.C.[167].

## Magna Graecia

### Sicily

Two bronze statuettes of Athena and two mirrors with supports fashioned in the Severe Style have been attributed to Sicilian workshops: peplophores of the Sicilian school are characterized by the adoption of elements of the Ionian style[168].

### Syracuse

Three bronze statuettes are, according to R. Tölle-Kastenbein[169], attributable to mid-5th century B.C. Syracusan workshops.

An Early Classical bronze statue found in the region of Selinus may be a local work[170], as may also be the bronze statuette of an athlete from Adrano[171]. Some pateras with handles in the shape of kuroi were probably also of local manufacture[172].

### South Italy

Epizephyrian Locri and Tarentum were the leading centres for metalworking in Southern Italy in Classical period. There is some evidence of bronzeworkshops in the area of the bay of Naples, at Poseidonia, and at Croton[173]. The attribution of 5th-century B.C. bronze sculptures poses difficult problems: one may surmise that sculptures like the Charioteer from Delphi[174], the warriors from Riace, and the Apollo from Piombino[175] were produced by the

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167 C. Reinsberg, 1980, 278, 293-294, N 1-3.

168 R. Tölle-Kastenbein, 1980, 174-179.

169 R. Tölle-Kastenbein, 1980, 171-173.

170 B.S. Ridgway, 1970, 40-41, N 10; A.M. Carruba, 1983; C.C. Mattusch, 1988, 135-138.

171 C.A. Di Stefano, 1990, 118-119.

172 C.A. Di Stefano, 1990, 118.

173 R. Tölle-Kastenbein, 1980, 191; I. Caruso, 1981, 105-106.

174 B.S. Ridgway, 1970, 33-34.

175 C. Rolley, 1983, 732-734.

sculptors from Magna Graecia. Southern Italian bronze statues of the Classical era are characterized by higher levels of artificial additions of lead, which were probably the result of contacts with metalworking centres in Etruria[176].

Epizephyrian Locri

Study of mirrors with sculptured handles from Southern Italy allows the centre of their manufacture to be identified as Locri, where the casting of mirrors had already begun in the second half of the 6th century B.C. and flourished in the Classical and Early Hellenistic eras, especially in the 5th century B.C.[177]. R. Tölle-Kastenbein attributes to local production a mirror with a support in the shape of a peplophore of ca. 450 B.C., which originated from the necropolis of Locri, as well as a stylistically homogenous group of statuettes of the first half of the 5th century B.C., which were fashioned following Ionian traditions[178]. Metalware was probably also manufactured in Locrian workshops; along with mirrors, various vessels are shown in details on local votive terracotta plaques of the 5th century B.C.[179].

Tarentum

Some bronze statuettes, including the figure of an athlete from the Metropolitan Museum, which go back to the sculptures of Myron, have been attributed to a 5th century B.C. workshop; two statuettes, including the figure of a maenad sitting on the rock and found in Dodona, have been credited to workshops of the late 5th-early 4th century B.C.[180].

A small group of hydriai whose handles are decorated with lion protomes and whose lower attachments are in the form of sirens, which can be dated to 470-440 B.C., are perhaps the products of a Tarentine workshop, although one opinion ascribes a Corinthian origin to them[181]. Silver vessels decorated with engravings, prob-

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176 P.T. Craddock, 1984, 231; D. Williams, 1989, 546; D. Haynes, 1992, 88; cf. A.M. Carruba, 1983, 43, 56. From the late 4th century B.C. statues of heavily-leaded bronze began to appear sporadically in mainland Greece and Asia Minor (see D. Haynes, 1992, 87-88, table 2).

177 B. D'Agostino, 1973, 225-227; F. Cameron, 1979, 51-57; C. Rolley, 1986a, 138-139.

178 R. Tölle-Kastenbein, 1980, 179-188.

179 See, e.g.: L. Forti, 1988, 288-289, figs. 346-347; 308, figs. 380-381.

180 P. Wuilleumier, 1968, 316-317.

181 E. Diehl, 1964, 25-28.

ably including rhyta[182], were manufactured in the Early Classical workshops of Tarentum.

There is a group of bronze mirrors with relief scenes on their lids, which W. Züchner saw as products of a toreutic school working in Tarentum under the strong Corinthian influence from approximately the second quarter of the 4th century B.C.[183].

Since the 5th century B.C. jewelry art at Tarentum was stimulated; it flourished in the second half of the 4th-3rd century B.C., when Tarentum became one of the leading toreutic centres in the ancient world[184].

## Lucania

Helmets of the so-called Southern Italic-Chalcidian type were manufactured in workshops in Lucania; moreover under the influence of Phrygian helmets which were widely distributed after the late 5th century B.C. a Phrygo-Chalcidian variant appeared[185].

## Apulia

In the 5th-4th centuries B.C. the workshops of Apulia continued the manufacture of Apulo-Corinthian helmets (fig. 31)[186]. From second half of the 5th century B.C. a characteristic type of armour was established widely in Southern Italy, which included helmets but also typical rectangular muscled cuirasses, which were manufactured in Paestum under strong Greek influence although typologically they are contemporary with Italic forms[187], and broad belts of the so-called Samnite type, which were probably produced in both workshops of the Greek colonies (Paestum, Capua) and in local workshops in Apulia and Lucania (Alfedene, Banzi)[188]. Metallographical study of a Samnite cuirass ("*kurzer Muskelpanzer*") and two helmets of the South Italic-Chalcidian type of the 5th century B.C. has shown that they were not hammered; they were cast from wax models in tin bronze with a tin content of 8-9%. Thus

[182] N. Nabers, R. Holloway, 1980, 71.

[183] W. Züchner, 1942, 206; P. Wuilleumier, 1968, 319-321.

[184] E.M. De Juliis, 1989a, 31-37; D. Musti et al., 1992, 42-43; P.G. Guzzo, 1993, 133.

[185] H. Pflug, 1988c, 145-147.

[186] A. Bottini, 1988, 111-112; *Armi in Lucania*, 1993, 187-189.

[187] P. Connoly, 1986, 117-118.

[188] See: M. Suano, 1986, 31-32; J.-L. Zimmermann, 1989a; *Armi in Lucania*, 1993, 177-179 (H.-M. von Kaenel).

the technology used in their manufacture differs from contemporary Greek and Etruscan usage[189]. An especially high volume of arms and armour was manufactured in the workshops of Southern Italy in the 4th century B.C. during the period of Roman-Samnite Wars. That is shown, in particular, by analysis of a matrix for stamping silver relief plaques for the decoration of bronze belts[190].

### Campania

A series of bronze statuettes of discoboloi, dated to ca. 490-470 B.C., is attributed to Campanian workshops. A Campanian style has been differentiated in small bronze plastics of the Archaic and Classical periods[191].

## The Black Sea Area

### Thrace

Under the influence of Chalcidian helmets a local helmet variant developed in Thrace, the Chalcido-Thracian or Thracian helmet[192]. Helmets of the Phrygian type, which spread from Italy to the Eastern Mediterranean and the Black Sea basin, may have been manufactured in Thracian workshops in the 4th century B.C. as well[193].

In the 4th century B.C. the courts of the Thracian dynasts, in particular, those of Odrysses, Cotys (383-359 B.C.), Cersebleptos (359-341 B.C.) and Satokes, housed workshops for the manufacture of silverware, whose new shapes, imitating Greek and Achaemenid prototypes, were created[194]. This is proved by inscriptions on vessels, for example twelve phialai from the Rogozen hoard. Besides the names of owners, various toponyms are mentioned: Beos, Arpos, Sauthaba, Ergiske and Geiston, which have been located in the south-east of Bulgaria[195]. There is a hypothesis that royal workshops were situated at all the sites mentioned[196].

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189 H. Born, 1989. See South-Italian Chalcidian helmets of the 4th century B.C.: *Armi in Lucania*, 1993, 215-219.

190 See, H.-M. von Kaenel, 1992; cf. M.Yu. Treister, 1994, 87-89; 1994b.

191 R.J. Riis, 1959, 1 ff.; C. Bossert-Radtke, 1990.

192 H. Pflug, 1988c, 141.

193 G. Waurick, 1988, 168, Abb.46.

194 Z.H. Archibald, 1989.

195 J. Hind, 1989, 40-41, fig. 4.

196 A. Fol, 1989.

This seems to be proven by analysis of the inscriptions on the vessels[197]. However, the unity of style and the graffiti also support the view that the vessels were fashioned in one workshop, which travelled with the royal court between the places mentioned[198]. There are also reasons for suggesting that a similar "travelling" workshop may have also existed at the court of Tryballes in Western Thrace in the second half of the 4th century B.C.[199].

## The North Pontic Area

Already in the Late Archaic period metalworking centres had been established, which specialized in the manufacture of arms and ornaments for the Scythians. The main ones were at Berezan, Olbia and Pantikapaion[200].

By the late 6th or early 5th century B.C. there may have been workshops which produced variants of bracelets with lion heads on their ends following Achaemenid prototypes[201]. It was most probably in Bosporan workshops of the the 5th century B.C. that an ornamental pattern was originally executed which served as the prototype for the "Heraclean knot", the so-called "*nordpontisch-kleinasiatischen Spangen*"[202].

In this period the decrease in importance of the late 6th-5th century B.C. Olbian school of metalworking went hand in hand with the emergence of a Bosporan school with its centre at Pantikapaion, which mainly specialized in toreutics[203]. It was probably here in the Late Classical period that masterpieces were produced such as the gold pectorals from Tolstaya Mogila and Bol'shya Bliznitsa, a torque from Kul'-Oba, a comb from Solokha, and a silver amphora from the Chertomlyk tumuli. According to some scholars, the pieces mentioned above, which are stylistically quite Greek but are permeated with Scythians elements, were the products of a single workshop or even craftsman, who is conventionally called the "Chertomlyk master"[204]. N.L. Grach added to

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197 See: G. Mihailov, 1987; 1988. G. Mihailov states: "le toponyme au genetif précede par la proposition ex (ek, eg) indique que l'objet ou le métal provient de la localité mentionnée" (G.Mihailov, 1987, 35).

198 K. Painter, 1989, 75-76.

199 C. Ewigleben, 1989.

200 M.Yu. Treister, 1992a, 80-83; in print.

201 M. Pfrommer, 1990, 100-103, Abb. 17.

202 M. Pfrommer, 1990, 11-13. Abb. 1.

203 E.V. Yakovenko, 1985.

204 W. Rudolph, 1986. See gold pectorals from Tolstaya Mogila (e.g. L.N.

the output of this workshop a series of round-bottomed vessels with ducks and three torment scenes from Kul'-Oba, a silver bowl from Solokha and a ritual vessel with images of Scythians from Kul'-Oba, and did not exclude the possibility that the workshop was located in Pantikapaion[205]. At the same time a group of articles has been disitinguished which were executed in clearly expressed Eastern traditions and are represented by one of the silver vessels found in Kul'-Oba and the gold scabbard overlays from Kul'-Oba, Ushakovskij tumulus and Solokha. These may have been manufactured either by Iranians employed in Bosporan workshops, as M.I. Artamonov has suggested[206], or by outsiders from the barbarian world, who worked in the traditions of Eastern art, as N.A. Onajko has considered[207], or, as N.L. Grach has proposed, in a centre in the east of the Pontic area, most probably in the Northern Caucasus, which had already been formed in the mid-5th century B.C.[208].

The centres of manufacture of the gold quiver overlays (*gorytoi*) found in the famous Scythian tumuli and at Vergina in Macedonia have been often discussed, with most scholars arguing that these workshops were located in the Bosporan area (Pantikapaion)[209]. However A.P. Mantsevich has disputed this attribution, and her position has been strengthened by the discovery of similar *gorytoi*

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Galanina, N.L. Grach, 1986, pls. 118-121), Bol'shya Bliznitsa (M.I. Artamonow, 1970, Abb. 295; L.N. Galanina, N.L. Grach, 1986, pls. 255-256), a torque from Kul'-Oba (L.N. Galanina, N.L. Grach, 1986, pls. 126-127; *Aus den Schatzkammern Eurasiens,* 1993, N 39 with references), a comb from Solokha (L.N. Galanina, N.L. Grach, 1986, pls. 128-129; *Aus den Schatzkammern Eurasiens,* 1993, N 44 with references), a silver amphora from Chertomlyk (M.I. Artamonow, 1970, Abb. 162-176; L.N. Galanina, N.L. Grach, 1986, pls. 265-268).

205 N.L. Grach, 1984, 102-1103. See round-bottomed vessels with the ducks and three torment scenes from Kul'-Oba (L.N. Galanina, N.L. Grach, 1986, pls. 188-189; 193-195; *Aus den Schatzkammern Eurasiens,* 1993, N 42, 43), a silver bowl from Solokha (M.I. Artamonow, 1970, Abb. 152-155) and a vessel with the images of Scythians from Kul'-Oba (L.N. Galanina, N.L. Grach, 1986, pls. 184-187; *Aus den Schatzkammern Eurasiens,* 1993, N 41).

206 M.I. Artamonow, 1970, 80, Abb. 145, 151.

207 N.A. Onajko, 1970, 32.

208 N.L. Grach, 1984, 105.

209 See *gorytoi,* e.g.: V. Schiltz, 1979; E.V. Chernenko, 1980; 1981, 67-89; L.N. Galanina, N.L. Grach, 1986, pls. 224-225; A.P. Mantsevich, 1987, 73-75; A.I. Terenozhkin, B.N. Mozolevskij, 1988, 121-128; *Aus den Schatzkammern Eurasiens,* 1993, N 62. About Bosporan origin of toreutics from Scythian tumuli, including *gorytoi* see, e.g. M.I. Rostovtzeff, 1931, 407-409; N.A. Onajko, 1974; 1976, 66-73; 1982, 252-253; E.V. Yakovenko, 1985, 341-352; *Tskhaltubo-III,* 1985 (communications by N.L. Grach- pp. 434-435; A.I. Boltunova- pp. 441-442); M. Mielczarek, 1986, 104-105; M.Yu. Treister, 1990, 30 ff.

in the Vergina tomb[210]. Nevertheless M. Andronicos is more cautious in assuming that gorytoi were produced in both Pantikapaion and Northern Greece and Macedonia[211]. It has also been maintained that the find from Vergina represents a war trophy taken by Philip II during his campaign against the Scythians in the Danubian basin[212]. Recently the "Trojan" series of *gorytoi* and scabbard overlays was dated to a small period of ca. 334-325/20 B.C., and a hypothesis was made to explain their manufacture at the order of Alexander the Great in the context of his attempt to penetrate into the Northern Pontic area[213].

The North-Eastern Pontic Area

There are reasons to hold that there was local toreutic produc-ion in the Greek colonies in Colchis. For instance, G.R. Tsetskhladze considers that a silver phiale with a dedication to Apollo Hegemon in Phasis, which dates from the last quarter of the 5th century B.C. and has both Greek and local features in its decoration, was made by a Greek craftsman in Phasis, a city which was a Greek colony at least between the middle of the 6th and 4th century B.C. The Greek craftsman had, in Tsetskhladze's opinion, catered to the tastes of the Colchian population or its ruling elite. However, he does not exclude the possibility that the phiale was made by a local Colchian craftsman on instructions from a Greek[214].

### *3.2.3. Classical Metalworking*

#### *3.2.3.1. General Characteristics*

An analysis of the manufacture of ceramics in Classical Athens proves that in contrast to the Archaic era it was organized on a more complex level than home production. One can thus distinguish specialized workshops, so-called "nucleated workshops" and

[210] See A.P. Mantsevich, 1980, 104-105; 1980a, 166. The *gorytoi* from Vergina see: *Makedonen*, 1994, N 259 with references (ca. 350-340 B.C.).

[211] See, e.g. M. Andronicos, 1984, 181-186.

[212] See, e.g. *Makedonen*, 1994, N 259.

[213] A.Yu. Alekseev, 1987; cf. the hypothesis of V.P. Yajlenko concerning the raid of Zopirion to Kamenskoe fortified settlement. See: V.P. Yajlenko, 1990, 349-360.

[214] G.R. Tsetskhaldze, 1994.

factories, i.e. large workshops, where craftsmen worked in the same building with some division of labour to produce highly specialized articles[215]. However, the term "factory" cannot be used in the context of the Athenian pottery industry in the Classical period. One should rather say that there were various levels of a division of labour in separate specialized workshops or "nucleated workshops". This term better reflects the links between workshops and local communities, the combination of the production of ceramics with another economic activities, the involvement of extended families in manufacture and the absence of any high degree of specialization[216].

The total number of craftsmen engaged in the production of ceramics in Athens in the 5th century B.C., i.e. in its heyday is estimated to be not higher than 500 persons. Their productivity was probably very high, however the production of ceramics had no major significance for the Athenian economy. According to A.M. Snodgrass, metalworking was a considerably more important part of Athenian craft industry in this period[217].

Undoubtedly, there were many small private workshops in Athens, in which a single craftsman worked alone or with one or more slaves, and where production was geared mainly to a local market[218]. Manufacture for export never played a significant role in Athens, according to S.C. Humphreys, although L. Neesen thinks that to a certain degree Athenian workshops, large and small, became famous in the 5th-4th century B.C. exactly because of their export focus, which is shown not only by the wide distribution of ceramics but also by the fact that arms were exported and ships equipped[219]. The predominance of small workshops in the structure of the Classical Athenian craft industry is demonstrated, in particular, by H.-G. Niemeyer's hypothesis about five workshops, in which statuettes of Athena Promachos were cast and by R.Tölle-Kastenbein's suggestion that one explain the change in the repertory of Attic toreuts in the second quarter of the 5th century B.C. by a change of craftsmen (see above on p. 202).

W. Züchner suggested that toreutic workshops may have existed in all the big production centres, however that small work-

[215] D. Peacock, 1982, 6-11.
[216] K. Arafat, C. Morgan, 1989, 323.
[217] A.M. Snodgrass, 1980, 128.
[218] G. Glotz, 1926, 267-268; Ch.G.Starr, 1977, 86.
[219] S.C. Humphreys, 1978, 148; cf. L. Neesen, 1989, 84-85, Anm. 100.

shops had very probably been highly dependent on enterprises in major centres, whose products dominated the markets[220].

The high level of specialization of Athenian metal workshops is shown by the fact that not only were there workshops specialized in treating different metals, but there was an even higher degree of specialization among craftsmen in the same profession, for instance, armourers (Aristophanes, Peace, 547), where helmets, cuirasses, machaires (Birds, 440), and spearheads (Peace, 447, 559) were manufactured in various workshops. Aristophanes mentioned craftsmen who made different types of agricultural implements, including specialised producers of ploughs (Peace, 548) and hoes (Peace, 547). Although of craftsmen working with gold Aristophanes wrote only about jewellers (Plutos, 164; Lysistrata, 408), but we know of at least four representatives of more specialised professions[221].

Analyzing the manufacture of mirrors in Epizephyrian Locri, F. Cameron tries to decide whether such a small town housed one big workshop or several small ones; whether there were workshops specialized in production of mirrors alone or whether each small workshop had one craftsman employed on this type of work. If various groups of mirrors could be distinguished on stylistic grounds, it would be possible to say that most probably there were four or five craftsmen in Locri, each with his own workshop with assistants and apprentices, producing various kinds of small bronze articles and even perhaps large ones. The craftsmen would have cast the most complicated details, for example handles with sculptured compositions which could be used not only for mirrors, but also for instance for pateras, whereas their assistants would have produced less difficult details or would have assembled finished objects. However as an analysis of the mirrors did not permit the differentiation of individual styles, F. Cameron came to the conclusion that Locrian bronzes had very probably originated from a single large workshop, which employed craftsmen of various levels and specializations. On the basis of the fact that most finds came from necropolis of Locri, Cameron suggested that the output of this workshop was geared mainly to local customers, who probably acquired mirrors directly at the workshop[222].

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220 W. Züchner, 1942, 156-157.

221 G. Glotz, 1926, 222; R.J. Forbes, 1964, 180; G.A. Koshelenko, 1983, 226; E. Kluwe, 1985, 34; see detailed bibliography: L. Neesen, 1989, 73-75. Anm. 88.

222 F. Cameron, 1979, 52-53.

The number of workers in a middle-sized temporary workshop specialized in the casting of life-size bronze statues would at the busiest times have varied from 8 to 12 apprentices together with a sculptor and founder. There may have been slaves among the apprentices. Such a workshop in a town would have experienced no problem in recruiting a labour force. In sanctuaries situated in agricultural localities, for instance in Olympia, workers from neighbouring villages may have been engaged. Against such a background we should note a casting pit probably used for making of the statue of Athena Promachos. According to G. Zimmer's calculations, the amount of bronze needed would have been somewhat less than 3 tons, which could have been smelted in 58 crucibles each with a capacity of 59 kg of metal. The labour of about 180 workers would have been required to smelt the metal and carry the crucibles[223].

There are grounds for suggesting that in the 5th century B.C. some at least of the workshops, in which such large-scale sculptures were cast, had been built with a view to their long-term use[224].

One might assume that the degree of specialization, even if it certainly was higher than in the Archaic era, was nevertheless determined by the size of the centres in which such specialist craftsmen worked, i.e. by the number of potential customers. Xenophon clearly indicated that in small towns the same master made both chairs and doors, ploughs and tables, and often he also built houses, being glad of any work he could obtain; in the large towns, however, craftsmen worked in only one branch of a craft and were sometimes even more specialized. Although Xenophon uses the example of shoemaking to illustrate the level of labour specialization, this tendency was in general typical of Classical Greece[225]. However, narrow specialization was not characteristic of prominent masters. For example Polignotos and Mykon were not only painters, but bronzeworkers as well (Paus. VI. 6.1; Plin. N.H. XXXIV. 88), whilst other craftsmen like Kanachos of Sicyon (Paus. IX. 10.2) or Kallon of Aegina (Paus. II. 32. 5) worked not only in marble and bronze but also in wood[226].

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[223] G. Zimmer, 1990, 171-172.

[224] G. Zimmer, 1993. Cf. with traditional view expressed, for instance, by D. Haynes (1992, 76): "There is no evidence to suggest that Greek casting-pits were kept in use for any length of time: after the completion of the particular commission for which it was designed, the pit was filled in".

[225] Ch.G. Starr, 1977, 86-87.

[226] B.S. Ridgway, 1970, 77.

This state of affairs is reflected in the use of techniques characteristic of bronze sculptures in the treatment of marble statues[227].

Some of the metalworking professions were extremely specialized. For instance, the building accounts of the Erechteion mention a gilder, the metic Sisyphos of Melita, who gilded rosettes. According V.D. Kuznetsov, he may not have been a professional gilder, but possibly a painter or goldsmith[228]. At the same time accounts relating to the extension of the porticus of Philo to the Thelesterion in the sanctuary of Demeter and Kore in Eleusis (IG II$^3$, 1673) and to repair work dated to 329/8 B.C. (IG II$^3$, 1672) make it evident that the 8 smiths mentioned were specialists of rather wide talents: they fabricated and sharpened iron tools, nails, cramps for joining stone blocks, keys, iron fittings for carriages and lifting devices. Among these smiths there were two citizens and five metics. It is thought that the craftsmen worked to order in their places of residence, except for when their presence on a building site was required. The articles that they manufactured were brought to the sanctuary (in particular, there is mention of 6 hammers made by Timopheus which cost 63 drachms and 3 obols)[229].

There was hardly any competition between the owners of individual workshops in the modern sense of the word and at first glance this would be the logical explanation for the appearance of so-called "damnation tablets" (*defixiones*). Among these we know of a 4th-century lead plaque with a damnation of the smiths Aristaichmos and Pyrrhias, their souls and their work, of a certain Sosios of Lamia, his soul and work, and of a Boeotian woman Hagesion. To judge by finds of remains of production, the tablet was situated in the yard of the house of a bronzeworker rather than of a smith[230]. V.N. Andreev doubted whether professional rivalry played a role in this context[231]. At the same time another 4th century B.C. lead tablet from Athens bears a damnation of Dionysius, a helmetmaker, of his wife, a gilder, as well as of their house and work and of a certain Kallippos[232]. It seems impossible to explain the appearance of these damnations in terms of per-

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[227] B.S. Ridgway, 1966; 1970, 33.

[228] V.D. Kuznetsov, 1990, 35.

[229] V.D. Kuznetsov, 1989, 136.

[230] R.S. Young, 1951, 223; A. Burford, 1972, 163-164; C.C. Mattusch, 1975, 95-96; 1977, 341-342.

[231] V.N. Andreev, 1983, 16-17.

[232] H. Lechat, 1889; IG, III$^2$, N 69; C.C. Mattusch, 1975, 94.

sonal relations alone; both tablets mention production (*ergasian*).

A certain proportion of metalworkers in Classical Athens were slaves. For example, documents mentioning the liberation of slaves dated to the second half of the 4th century B.C., refer to bronzeworkers, three goldsmiths and one coppersmith[233]. Slaves are known to have been coppersmiths and shieldmakers (Demosth. XLIX. 51-52; XXVI. 11), and craftsmen making knives and couches (Demosth. XXVII. 9). However slave labour in the area of craft industry grew in significance in Athens, firstly, because of wars, which required increases in the production of arms and of other war materials, and secondly, because of the withdrawal of free labour from craft production. This was caused by requirement for citizens to perform military service in time of war, and to undertake civil functions in peacetime in consequence of a sophisticated system of election to such positions. One can assume that in metalworking—unlike mining[234]—free labour predominated[235], whereas hired labour grew in importance in the 4th century B.C. by contrast to the previous era[236]. S. Mrozek thinks that hired free labour—chiefly in the form of skilled craftsmen—was used in the production of arms, especially of new types such as catapults[237].

### *3.2.3.2. The Process of Forming Large Metal Workshops*

In this period private metalworking shops existed side-by-side with large newly established state workshops, geared mainly to the production of arms[238]. As S.C. Humphreys has stated, the Greco-Persian Wars and the growing military activity of Athens had led to cardinal changes in the places of war and trade in the Greek economy. In the 5th century Athens followed Sparta in making war the crux of her economy[239].

There is no evidence to show how the system worked. However we can imagine that orders were accommodated by large private workshops and newly organized state ergasteries. Even if arms and armour for hoplites could have been produced in various private

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[233] A.I. Dovatur, 1980, 75.
[234] J.F. Healy, 1978, 132-133; Y. Garlan, 1982, 66-67; 78-79.
[235] A.I. Dovatur, 1980, 85; Y. Garlan, 1982, 77-78; S. Mrozek, 1989, 28.
[236] S. Mrozek, 1989, 28-29.
[237] S. Mrozek, 1989, 30.
[238] L. Neesen, 1989, 82-83.
[239] S.C. Humphreys, 1978, 171.

workshops, the task of constructing and equipping fleets was much more difficult and complicated—large amounts of metal were necessary for casting the metal parts of warships, particularly the rams and this led to the appearance of metal workshops in docks. Some corroboration for this hypothesis is to be found in the narrative sources. We know of the existence of a shield workshop belonging to the metic Polemarchos, which employed 120 slaves; 52 or 53 slaves worked in a factory owned by the father of Demosthenes, where knives and couches were manufactured[240]. A decree, mentioned by Demosthenes, states that Chairedemes and Diotimes had donated 800 shields for the equipment of *neanisks*[241]. Among the belongings seized by the representatives of the Thirties in 404 B.C. from the houses of Lysias, who with his brother co-owned a shield workshop employing 120 slaves (some scholars think that this number also includes domestic slaves), there is mention of 700 shields (Lys. XII. 8)[242].

It can be supposed that in Classical Athens the spread of large workshops, including state factories, and the growth in the number of craftsmen engaged in the manufacture of a standard product, led to a sharpening of the differences between artists and craftsmen[243].

There are grounds for thinking that the state system for supplying arms in Athens was established gradually in the course of the 5th century B.C., and that it was probably originally only used in the organization of the construction and repair of battleships. In any case it is precisely for the construction of battle fleets that one would expect large workshops to have first appeared[244]. We should perhaps look for a beginning in the reforms of Themistocles, for he built an Athenian war fleet in the shortest possible space of time[245]. Ch.G. Starr suggests this as a way in which wood and hemp could have been obtained[246], but forgets all about metals. None of this is very likely if there had been no state organisation of supplies of raw materials. Unfortunately, no

[240] A. Burford, 1972, 43.
[241] W.K. Pritchett, 1971, 4, note 3.
[242] A.I. Dovatur, 1980, 72; S.-G.Gröschel, 1989, 84.
[243] S.C. Humphreys, 1978, 149.
[244] Ch.G. Starr, 1977, 86.
[245] See, e.g.: R. Meiggs, 1982, 122-25. It is maintained that even in the period of economic crisis by 387/6 Athens had probably some 70 ships. See: R.K. Sinclair, 1978, 49-52.
[246] C.G. Starr, 1989, 30.

details of the Themistoclean reorganization of the Athenian fleet are known, however the earliest mention of a board of overseers of a shipyard (IG $I^2$ 73) is dated to between 450 and 435 B.C., at least according to B. Jordan[247], who adverts to passages in Plato and Plutarch about the construction of dockyards at Piraeus by Themistocles (Pl. Gorg. 455 e; Plut. Them. 4. 1-3). His suggestion that Themistocles was the author of the administrative organization of the Athenian fleet is at least probable. It is indirectly proved by the evidence of Diodorus (XI. 43.3) that Themistocles had convinced the *demos* to free metics and craftsmen from civic duties in order to attract more of them to the city and to promote the development of crafts. Both these considerations had been deemed by him to be vital for the establishment of naval power[248]. According to D. Whitehead, the date mentioned by Diodorus—477/6 B.C.—is fairly unreliable; it should be considerably before 480 B.C., i.e. the time of the construction of the fleet by Themistocles, but these changes led to the formation of permanent workshops[249]. The financial resources needed to finish the fleet were provided by the silver mines at Laurion; at Themistocles' initiative it was decided not to share this income out between the citizens, as the Siphnians had done with the income from their mines (Hdt. III. 57). This fact is accepted by all scholars. More complex are questions concerning the income from the mines and the numbers of ships built. Here there are differences in both the evidence of ancient writers and in their modern interpretations. For example, the income from the exploitation of the mines is estimated at between 50 and 200 talents, whereas estimates of the number of ships built vary from 100 to 200[250]. In any case it is possible to posit a certain interdependence between the organization of mining and the beginnings of a process by which state metal workshops were developed. Control by the *poleis* over the building and repair of battleships was still in the hands of various magistrates between the last third of the 5th and the 4th century B.C.[251].

The development of metal workshops in Classical Athens required a search for reliable sources of fuel: wood and charcoal.

247 B. Jordan, 1975, 17-20.
248 L. Neesen, 1989, 70, Anm. 84.
249 D. Whitehead, 1977, 148-149.
250 P.J. Rhodes, 1981, 277-279.
251 See: B. Jordan, 1975, 21 f.; A. French, 1991, 34-35.

Inscriptions referring to the casting of the colossal sculpture of Athena Promachos on the Acropolis and the statues of Hephaistos and Athena for the temple of Hephaistos mentioned both materials as necessary for casting. According to R. Meiggs, if it was the practice in Attica to smelt iron from ore rather than to import it as ingots, this should have led to a growth in demand for fuel, especially for charcoal[252].

S.D. Olson recently concluded that Classical Athens was a fuel-hungry society, which developed an elaborate system to satisfy its constant need for charcoal and firewood[253]. That wood was imported from Chalcidike in the mid-4th century B.C. is proved by a lead letter found at Torone dealing with a commercial transaction; it is interesting that the author of the letter was unable to buy wood in Mende(?). A. Henry associates this need for wood with metalworking, referring also to a passage in Demosthenes' speech against Meidias, in which it is alleged that Meidias as trierach had made private use of his ship to bring back various materials from Styros including wood for his silver mines (Demosth. XXI.167). This wood was probably to be used either in his furnaces or perhaps as pit-props for his mines[254].

The arms and armour brought to the Athenian Chalkotheke and to other temples were seen as both metal votives and as additions to the arsenal of the poleis[255]. What is the pre-history of such arsenals? It is known that Homeric heroes kept large numbers of weapons in their houses; these arms were intended not only for the owner but also to equip the most prominent of his followers. The custom of keeping arms in the main room of the house was still in vogue in the first third of the 6th century B.C. It showed the constant readiness of the Greek aristocrat for war. However, in the Classical period the general diffusion of arms and the unwillingness of the cities to allow large quantities of arms to be concentrated in private houses led gradually to the disappearance of the custom[256]. When did the new practice become common? If one can explain finds of arms and armour of the 6th century B.C. on the Athenian Acropolis in terms of such storage, then it may have already been in use from the Late Archaic period. However, we should not overlook the following. In the inventories of the

[252] R. Meiggs, 1982, 204.
[253] S.D. Olson, 1991, 419.
[254] A. Henry, 1991, 69.
[255] W.K. Pritchett, 1979, 256-257.
[256] S.-G. Gröschel, 1989, 80-85.

treasury of Athena, dating to the 5th century B.C., for which the lists from 434-405 B.C. have been preserved practically complete, there is no single reference to a piece from an arsenal. After 386/5 B.C. the keepers of the treasuries issued inventories, which listed objects, wherever they came from and wherever they were kept—these including arms and armour[257]. The remains of the Athenian Chalkotheke were traced archaeologically in the course of excavations in 1886-87 conducted by W. Dörpfeld. G. Stivens dated the construction of the Chalkotheke to ca. 450 B.C. and the extension of the portico to ca. 400 B.C. Recent study of epigraphical sources and architectural analysis of the excavated building remains (fig. 32) prove that the Chalkotheke was constructed at a later date—in the 370s B.C. This was a period of an "imperialistic" direction in Athens' revival, when the Second Athenian League of maritime states was established, the time in which Athens and Piraeus were refortified and the era in which administrative controls were increased[258]. The constitution of the Second Athenian League was accompanied by a reform in 378/7 B.C. of the finances of the army and fleet[259]. One should not forget that practically the same period saw the revival of large-scale silver mining in Laurion which was one of the reasons behind the decree of Nikophon of 375/4 B.C. adopting silver coinage[260] Most probably the construction of the Chalkotheke was directly connected with a general reorganisation in 374/3 B.C of the treasuries of Athena. The earliest reference to the building in inscriptions goes back to 371/0 B.C. In the course of time the function of the treasury as a storage place for bronzes changed more and more into that of an arsenal: an inscription of 321/0 B.C. leads to the conclusion that it was primarily used to store artillery and naval equipment. However, architectural analysis of the remains of the building does not allow us to say that it was originally intended as an arsenal, although weaponry was already kept there in 371/0 B.C.[261].

In 347 B.C. the Athenian *boule* decided to construct a stone arsenal for the fleet at Piraeus, which had clearly been built by 330 B.C.; this is shown by an inscription from 330/29 B.C. giving sea lists (IG II$^2$, 1627b), which mention a stock of iron cramps taken

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257 W.K. Pritchett, 1979, 258.

258 L. La Follette, 1986, 86-87.

259 P. Brun, 1983, 28-29, 170-176; G.L. Cawkwell, 1984; D. Whitehead, 1986, 132-133; J. Ober, 1989, 99-100; A. French, 1991, 34.

260 S. Alessandri, 1984, 381-385.

261 L. La Follette, 1986.

from the arsenal. Evidently, the arsenal was intended for the storage of triremes and was planned to house no more than 134 ships. Although the arsenal was planned as a purely military building, Philo's architectural concept aimed to produce a building conforming to architectural norms (fig. 33)[262].

The earliest example mentioned in our sources of the Athenian state supplying weapons for part of an army is dated to 414/3 B.C. Describing the events of the Sicilian expedition, Thucydides contrasted *hoplites ek katalogou* and *hoplites-tetes*, i.e. those lacking the means for enrolment as hoplites (VI. 43). According to the commentators of Thucydides[263], the latter were supplied with arms and armour at the expense of the state, but this does not to my mind necessarily mean that they obtained them directly from state stores or workshops.

One cannot rule out the possibility that in the time of Aristotle (Ath. Pol. 42.4) the practice of presenting an ephebe, who had finished military training, with a shield and a spear was connected with the establishment of state stores of weaponry. Plato (Menexenos 249a) mentioned that those who became orphans as a result of war received a panoply. One *poleis* might also supply arms to another, as was the case in 335/4 B.C., when Athens at the instigation of Demosthenes gave weapons to Thebes in order that all its citizens might be provided with heavy armour (Diod. XVII. 8.5).

W.K. Pritchett is unhappy to say when the state redistribution of arms and armour from arsenals came in vogue[264], however it seems evident that it could not have been very common before the first decades of the 4th century B.C. and then not everywhere.

Sparta may have pioneered such practice. S.C. Humphreys' view that Sparta, in turning warfare into the main element of its economic system, planned to obtain most of what it needed to arm its hoplites as spoils of war[265], seems somewhat of a caricature, and, anyway, contradicts the Spartan attitude to war booty, outlined by W.K. Pritchett (see above on p. 111). The idea that Sparta may have supplied its citizens with arms was first put forward by M. Finley, who did not pause too long on the problem of the chronology of the system of state supply of the army (he dis-

262 K. Jeppesen, 1958, 69-101; see the new reconstruction on base of the inscription IG II$^2$ 1668: J. de Waele, 1993.
263 A.W. Gomme et al., 1970, 310.
264 W.K. Pritchett, 1979, 259, note 79.
265 S.C. Humphreys, 1978, 171.

cussed in an article the period from the mid-6th century B.C. till the battle at Leuctra in 371 B.C.[266]). Although Finley himself later wrote that the problem of the production and distribution of arms had not yet been finally resolved, this task may have fallen to the *perioikoi*[267], Pritchett supported his original standpoint and stated citing Nepo (Ages. III. 2) that the Spartan king Agesilaes in 395 B.C. organized the manufacture, repair and supply of weapons to the army at Ephesus[268]. L. Neesen stated that as the number of Spartiats fell in the 6th-5th century B.C. the importance of the *perioikoi* to the Lacedaemonian war machine grew[269]. Xenophon (Cyr. III. 4. 17) wrote that Ephesus had became a military workshop[270]. In an article published in 1977 P. Cartledge suggested that the system of supplying arms and armour to Spartan citizens as well as to *helots* and former *helots* was adopted either during or just after the end of the Second Messenian War[271]. He later stated that from at least 424 B.C. the Spartan state supplied arms and armour at its own expense to *helots* and *neodamodeis*, who were on garrison duty[272]. In his words, "in the world of *amateur militias* the Spartan hoplites were the only soldiers who may be characterized as professionals", which had already been noted by Xenophon and Plutarch[273]. The reason for this was that unlike other Greek cities, who could mobilize as hoplites only that third of their citizenry able to meet the expense of military equipment, all Spartan citizens became hoplites in wartime. Cartledge holds that we have no clear picture of the mechanism by which Spartan hoplites were supplied, but he thinks that it was not "market" driven. Supply to hoplites was centralized somewhere, perhaps even by requisitions from the *perioikoi.* Bronze for shields was probably brought via the main settlement of *perioikoi* at Hyteion, which was defended by a wall in at least the 360s B.C.[274]. Cartledge discusses the events described by Xenophon (Hell. VI.4.10 f.), dated to ca. 399 B.C., when during the plot of Cynadones the

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[266] M.I. Finley, 1968, 149.

[267] M.I. Finley, 1983b, 29.

[268] W.K. Pritchett, 1971, 4, note 3. However, despite his successes, Agesilaes' war policy in Asia seems to have been somewhat nebulous and opportunist, with little evidence of a coherent plan. See: G. Wylie, 1992.

[269] L. Neesen, 1989, 39-40.

[270] See also: P. Cartledge, 1987, 214.

[271] P. Cartledge, 1977, 27.

[272] P. Cartledge, 1979, 185; 1987, 39.

[273] P. Cartledge, 1987, 43-44.

[274] P. Cartledge, 1987, 44, 178.

rebels had to seize weapons from "iron storage", and he sees in this evidence reference to some central Spartan military arsenal[275]. The view that arms and armour were probably supplied by the state in Sparta is shared by S. Hodkinson[276], however J. Lazenby treats it with caution[277]. It is possible that following Spartan practice, state supply of the army was first employed by Dionysius and then in Athens.

The role of the "younger tyrants" and especially of Dionysius in this process should be stressed. It was an integral part of an administrative-political system of a new type, combining elements drawn from the organization of the *poleis*, autonomy and territorial monarchy with an absolutist regime, transition to which was taking place everywhere in the Greek world[278].

According to Diodorus (XIV. 41), Syracuse possessed an arsenal in 399 B.C. Dionysius offered good terms for loans and taxed the towns[279] and then "gathered skilled workmen, commandeering them from the cities under his control and attracting them by high wages from Italy and Greece as well as Carthaginian territory. For his purpose was to make weapons in great numbers and every kind of missile, and also quadriremes and quinqueremes... After collecting many skilled workmen, he divided them into groups in accordance with their skills, and appointed over them the most conspicuous citizens, offering great bounties to any who created a supply of arms... And since the Syracusans enthusiastically supported the policy of Dionysius, it came to pass that rivalry rose high to manufacture the arms. For not only was every space, such as the porticoes and back rooms of the temples as well as the gymnasia and colonnades of the market place, crowded with workers, but the making of great quantities of arms went on, apart from such public places, in the most distinguished homes" (transl. by C.H. Oldfather).

Diodorus stated (XIV. 43) that no less than 140,000 shields and 14,000 cuirasses were manufactured[280]. The year 399 B.C., in

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[275] P. Cartledge, 1979, 314.

[276] S.J. Hodkinson, 1983, 256.

[277] J.F. Lazenby, 1985, 74, 187, note 34.

[278] E.D. Frolov, 1979, 46-47; 1979a; 1983, 146-147.

[279] E.D. Frolov, 1979, 43; 1979a, 71-72.

[280] B. Caven, 1990, 93-97; cf. various points of view concerning the quantity of Dionysius' troops; so, E.D. Frolov (1979a, 114-115) considers, that the data about the forces of Dionysius in the start of his last war with Carthage are quite real. They are the following: 30 000 infantrymen, 3 000 riders and 300 battle ships; besides, the detachment of Dionysius guard is estimated in 10 000 warriors

which the non-torsion (crossbow style) catapult was invented in Syracuse as an assault weapon (Diod. XIV. 41.4), is usually considered to be the birthyear of Greek artillery[281]. Within a few years Carthage had followed the example of Dionysius (Diod. XIV. 49. 1)[282].

Artillery technology was quickly adapted for the use of defenders. By the second quarter of the 4th century, fortress towers often incorporated specially designed catapult chambers. Catapults could also be adapted as field artillery[283].

The stimulus for the development of state armories in Sicily arose with the particular state of affairs which occurred here: this new state institution was not only the result of a subordination to global war, to the conquest of enemy territory and the enslavement of foreign populations, but also the drawing together of the Greek towns in face of a threat from without—attack by Carthage. E.D. Frolov mentions that the war in the Greek West was a stimulating factor but not directly a creative one[284].

It seems evident that the development of a state system of armories was stimulated by the employment of mercenary soldiers in the 4th century B.C., the further professionalization of military activity, and the creation of more specialized contingents of troops. The main period for the hiring of mercenary troops starts, according to H. Parke, with the epoch of Cyrus II and Dionysius I[285]. Dionysius set up workshops with the express purpose of equipping mercenaries. J. Roy thought that the Persian king Cyrus also provided his Greek mercenaries with armour and, most probably, arms; in any case he organized workshops to repair them[286]. However, the system by which mercenaries were equipped has not been conclusively explained: it may not have been universal and could have been only used when big contingents were hired, mainly, by tyrants; there is no evidence for the hiring of mercenaries by Greek city-states[287]. The problem of how mercenaries were equipped in Classical Greece leaves ample

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(E.D.Frolov, 1979a, 118-119), the equipment for the mentioned troops was most probably done in Syracuse.

281 E.W. Marsden, 1969, 48-49; J. Ober, 1991, 191.

282 B. Wollner, 1987, 39-41.

283 E.W. Marsden, 1969, 59-60; J. Ober, 1991, 191.

284 E.D. Frolov, 1983, 147.

285 H.W. Parke, 1970, 20-22.

286 J. Roy, 1967, 310.

287 L.P. Marinovich, 1975, 139.

room for discussion. For example the idea recently put forward by P. MacKechnie that this did in fact take place, has been criticized by D. Whitehead[288].

In the mid-4th century B.C. the system was adopted by Philip of Macedon. Thucydides reports (II. 100.1) that Archaelaus, the son of Perdikka (413-399 B.C.), had already improved the equipment of his troops, although this does not mean that they had been upgraded to hoplites. Philip II, who had learned the military art from one of the best commanders in Greece of that period, Epaminondas of Thebes, raised the organization of the Macedonian army to quite a different level. Excavations at Olynthus, conquered by the Macedonians in 348 B.C. indicate the high level to which siege artillery, including catapults and other ballistic engines, had developed. Not only were the bronze and iron parts of these mechanisms—Philip carried their development further than Dionysius, whose experience he had used—cast in the Macedonian armories[289], but so too were numerous bronze arrowheads for catapults and lead missiles with the inscription "PHILIPPO(U)"[290], as well as the heads of sarissas and armour. Macedonian military engineers had made a major breakthrough in artillery technology with the development of the torsion (hair- or sinew-spring) catapult, which was much more powerful than old non-torsion models[291].

Diodorus (XVI. 3.1) mentioned that Philip had improved the tactical training of soldiers and had equipped them with arms accordingly: "...bringing together the Macedonians in a series of assemblies and exhorting them with eloquent speeches to be men, he built up their morale, and, having improved the organization of his forces and equipped the men suitably with weapons of war, he held constant manoeuvres of the men under arms and competitive drills" (transl. by C.L. Sherman). According to N. Griffiths, Diodorus meant that soldiers had equipped themselves with arms and armour independently or paid a special tax for it, although N. Hammond thinks that the ancient writer turned to the idea of the state supply of weapons, because there was also too little time to equip the soldiers with standard arms and armour.

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288 P. MacKechnie, 1989, 80-85; cf. D. Whitehead, 1991.
289 B. Caven, 1990, 250.
290 See, e.g., D.M. Robinson, 1941, N 1907, pl. CXX; *Makedonen*, 1994, N 253.
291 E.W. Marsden, 1969, 56-62; J. Ober, 1991, 192.

The Macedonian king had at his disposal all the necessary resources, including copper and iron mines[292].

This supply system formed the basis of Alexander the Great's strategy[293]. The effectiveness of this system is proved by the way panoply was delivered to Alexander's army on the Indus (Curt. IX. 3. 21: "Meanwhile Memnon had brought from Thrace a reinforcement of 5000 horsemen, and besides these 7000 foot-soldiers from Harpalus, for 25,000 men sets of armour inlaid with gold and silver. These Alexander distributed and ordered the old ones to be burned") (transl. by J.C. Rolfe)[294]. It is thus reasonable to assume that there were no armories in the army of Alexander the Great, moreover it was felt that the costs of supplying arms and armour to at least some detachments of the Macedonian army, for instance to the cavalry, should be met by the soldiers themselves[295]. Even if this was so, it was evidently not the case with the infantry, which included contingents from various peoples and where the use of the phalanx presupposed not only training in new battle tactics[296], but also equipment with a uniform type of weapon. In the case of the construction of a fleet during preparations for Alexander's expedition to the Gulf, part of the programme was certainly financed by Alexander himself, whereas the costs of the rest were probably shared between various cities of the Eastern Mediterranean[297]. Arrian (An. VII. 19. 3), referring to Aristobulos, mentioned 47 ships which were brought in parts from Phoenicia: "two Phoenician quinqueremes, three quadriremes, and twelve triremes; and about thirty thirty-oared galleys. These had been taken to pieces and carried across from Phoenicia to the Euphrates, to the city of Thapsacus; and there they were put together again and sailed down to Babylon" (transl. by E. Iliff Robson)[298]. According to Curtius Rufus (X. 1. 19), Alexander "... ordered the governors of Mesopotamia to cut timber on Mt. Libanus, transport it to Thapsacus, a city of Syria, and lay the keels of 700 ships; all were to be septiremes, and to be taken to

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292 N.G.L. Hammond, 1989, 104, note 14.
293 D.W. Engels, 1978, 119.
294 A.M. Snodgrass, 1967, 116-117; P. Ducrey, 1986, 207-208; N.G.L. Hammond, 1989a, 217.
295 H. Schwartz, 1982, 28-30.
296 H. Schwartz, 1982, 98-101; A.B. Bosworth, 1988, 259-277.
297 R.D. Milns, 1987, 252-253.
298 J. Seibert, 1985, 188.

Babylon. The kings of the Cypriotes were ordered to furnish copper, hemp and sails" (transl. by J.C. Rolfe).

I think that the practice of distributing weapons by the state is an event of the same order as the establishment of state armories by Dionysius in 399 B.C. It was a predecessor of the type of redistribution of metal objects practised in the Hellenistic monarchies.

In the Early Hellenistic period the system of distribution of arms and armour by the *poleis* was wide-spread; this is shown for example by inscriptions from Thasos and Theos and a reference by Diodorus (XX.84.3-4) to the distribution of panoply in Rhodes in 305 B.C.[299].

The cost of maintaining an army and even more so of a fleet, even in peacetime, was considerably higher than the expense, for instance, of major building programmes, and ran into thousands of talents[300].

Monetary courts developed to some extent in parallel with the system of state or *poleis* armories. They developed in parallel primarily in the sense that preparations for and the prosecution of military campaigns, especially with the growth in the employment of mercenaries, led to a increasing need for coins and thus for corresponding amounts of metal, unless some special arrangements had been made. Study of coin statistics leads us to conclude that coins were issued on an irregular basis. Many city-states did not strike coins for years. It is difficult to say how exactly the monetary courts were organized, especially in small cities. Did they belong to the state or were they farmed out? Analyzing the 6th-5th century B.C. coinage of Cnidus, H.A. Cahn came to the conclusion that the mint was closed for years, while the engravers of the dies and those who struck coins were appointed ad hoc as necessity arose[301]. T. Hackens gave other examples of such irregularity in the coinage of the 5th-4th century B.C. (fig. 34)[302]. This was also the case in the Hellenistic period (see below on p. 346). How could a Greek *poleis* meet its requirements for workers for such mints? One would be justified in thinking that these were drawn from the general reserve of labour: either they were resident craftsmen or itinerant craftsmen.

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299 L. Robert, J. Robert, 1976, 219-222; W.K. Pritchett, 1979, 259, note 79.
300 See: M.L. Cook, 1990.
301 H.A. Cahn, 1970, 143-144.
302 T. Hackens, 1987, 8-10.

### *3.2.3.3. The Specialization of Craft Industry, the Copying and Reproduction of Originals*

M. Maass found letter marks on the handles of hydriai originating from Thebes, which following E. Diehl's classification, could be dated to after 480 B.C. Analysis of the engraving style of such attachments also shows that they were the work of various craftsmen, and that there was a division of labour in what looks like the mass production of hydriai, mirrors and other articles especially in the second half of the 5th-4th century B.C.[303]. Several craftsmen were employed on the manufacture of a krater with Dionysiac scenes from Derveni[304].

The specialisation of labour in the ateliers of sculptors which had sprung up by the Late Archaic era is shown by the images on the Berlin cup of the early 5th century B.C. C.C. Mattusch sees in the two figures on side B of the cup a sculptor and a founder and assumes that some specialisation came into being with the introduction of the technique for casting life-size bronze statues. The lost-wax hollow casting technique is usually linked with the names of Rhoikos and Theodoros. Mattusch supposes that such specialisation inevitably appeared with the invention of the indirect casting of sculptures as parts[305]. However, Mattusch's standpoint is not above dispute. G. Zimmer is perhaps right to criticize it: he holds that the earliest examples of specialisation of labour between sculptors and founders are represented by inscriptions on the bases of statues from Rhodes dating to ca. 270 B.C.[306]. H. Philipp considers that one of the figures on the Berlin cup represents an owner who is giving instructions to apprentices engaged in the cold treatment of a statue, whilst the other figure is his guest[307]. At the same time, and perhaps already in the Early Classical period when the life-size bronze statuary was being cast in the case of large orders, e.g. for groups of sculptures, there was probably some division of labour between workshops. Just how common the practice of casting such sculptural groups was and an idea of how many statues were cast can be drawn from the follow-

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[303] M. Maass, 1983, 13-15.
[304] C. Rolley, 1986a, 183.
[305] C.C. Mattusch, 1980, 441; 1988, 120-121; 1988a; 1990a; see also D. Haynes, 1992, 48-49, 55. See about Kritios and Nesiotes,e.g.: B.S. Ridgway, 1970, 79-83.
[306] G. Zimmer, 1985, 47.
[307] H. Philipp, 1990, 92.

ing examples. Kalamis cast a series of juvenile statues which stood along the Altis wall in Olympia (Paus. V. 25. 6). Lykios was the creator of 23 statues, which were mounted on the same base in Olympia (Paus. V. 22. 2). Nine sculptors were engaged in the manufacture of the monument to honour the Spartan victory at Egospotames which was composed of approximately 36 figures at Delphi (Paus. X. 9. 6-10). In the 5th century B.C. a monument to eponymous heroes and composed of many sculptures was installed at Athens[308]. This hypothesis is supported by the base of the monument which bears the remains of a mounting for four sculptures and the signatures of four craftsmen (these are however open to various interpretations[309]), but also by analysis of the two statues of warriors from the shipwreck at Riace. This allows P.C. Bol to suggest that it was not produced by a group of different craftsmen; the existing bronze workshops divided up the work in such a way that each of them executed part of it from the making of a wax model to the cold treatment and installation of the sculpture. In the context of a single project there was considerable freedom of stylistic decision and this is clearly seen in the Riace bronzes[310]. There are different views concerning the dating of Riace bronzes, including some which make Bol's hypotheses impossible (in particular C. Rolley's suggestion that statues A and B differ by 30 years[311]; see the survey of the various views below on p. 243). Nevertheless C.C. Mattusch's remark that a striking similarity between the statues in terms of poses, gestures and dimensions may be explained by the lost-wax method of manufacture (both statues probably had the same "rough" base model, from which wax models were cast, and were then given further individual features[312]), shows that Bol's hypothesis is in principle possible. However, whether we are dealing with specialisation between independent craftsmen or workshops or within one workshop is a question which cannot be properly solved at present. The technological study of Riace statues undertaken by E. Formigli shows that there were differences in the composition of the alloys and of clay

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308 C.C. Mattusch, 1990a.

309 So, F. Eckstein (1969, 63 f., 123, Anm. 16) supposed that two craftsmen: Athenadores and Asopodores were the authors of the artistic concept of the sculptural group, while the two others: Asopos and Asopodores were the founders.

310 P.C. Bol, 1985, 165-168.

311 C. Rolley, 1986a, 44.

312 C.C. Mattusch, 1988, 208.

cores[313]. This would seem to confirm Bol's idea that the Riace bronzes were cast in different workshops. Mattusch comes to a similar conclusion in one of her later publications, stating that wherever the base model had been made, moulds taken from it could easily be packed up and sent on to craftsmen with an order to fulfil so that they could make a wax model even in another workshop or another city. This method involved the bore dubbing of wax models, however allowed craftsmen to add new details to statues in the process of making them. It was not thus the same as the mechanical copying which became common in the following period[314], although one cannot rule out the possibility that certain attempts at exact mechanical copying had been made, for example, by Myron: the statue of a cow cast by him was hardly distinguishable from its prototype[315]. In many cases not only were sculptors from various workshops engaged in work on the same monument, but even representatives of different schools, like Simon of Aegina and Dionysius of Argos (Paus. V. 27. 2)[316].

It is perhaps a result of the process of specialization in metalworking, on one hand, and of the considerable number of orders for the manufacture of bronze statuary, on the other, that there are practically no remains of fixed-site workshops of the 5th-4th centuries B.C. Most of the known Classical workshops are represented by casting pits which were constructed in order to make one or more sculptures. The dimensions of casting pits of the 4th century B.C. and improvements in their technical characteristics show that there was some progress in the manufacture of bronze statues[317].

The production of.fairly exact reproductions was also common in toreutics in the 4th century B.C. The classical example is a series of gold and silver overlays of *gorytoi* and scabbards[318]. All the reliefs on the *gorytoi* of the so-called "Chertomlyk" series (showing scenes from the life of Achilles) were struck from one matrix

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313 E. Formigli, 1985. Cf. G. Schneider, 1989; 1989a: samples of ceramic materials used in bronze casting, including these from the debris of the 5th century workshops at Olympia and Athens and from cores of large bronzes from Riace, Piraeus and Kythera have shown that moulds in each case were made from local clays.

314 C.C. Mattusch, 1990a.

315 C.C. Mattusch, 1975, 52.

316 B.S. Ridgway, 1970, 76-77.

317 See: G. Zimmer, 1990, 73-74, 83.

318 See, e.g.: V. Schiltz, 1979; E.V. Chernenko, 1980; 1981, 67-89; A.P. Mantsevich, 1987, 73-75; A.I. Terenozhkin, B.N. Mozolevskij, 1988, 121-128.

which was recarved in the course of their manufacture: additional reworking of some of the details of each *gorytoi* overlay led to noticeable individual differences between them[319]. Study of a bronze matrix from the Pergamon Museum in Berlin[320] and of a bronze belt with silver plaques from the Laos necropolis in Lucania[321] shows that matrices were used in the mass production of the details of Samnite girdle decorations in the late 4th century B.C. As with the example involving the copying of overlays of *gorytoi*, the technique characteristically used in making reproductions from matrices led to individual variations between separate series of struck decorations[322]. We can consider the following observations: the use of matrices for the manufacture of series of articles presupposed production: in the first instance of details of weapons; secondly, the use of precious metals; thirdly, some special purpose for the series of articles involved: either as decoration for cuirasses, or, as is quite probable, as diplomatic gifts. In either case, however, it is quite possible that such matrices were employed in royal workshops.

### *3.2.3.4. Workshops and Schools*

Already in the Early Classical period there was a tendency for different workshops in various centres to communicate new technical methods, shapes and motifs from one to the other. This was to a considerable extent due to the custom of inviting leading craftsmen to fulfil given orders. This makes it very difficult to attribute pieces produced in separate workshops (see above): for example, of the small plastics of the Severe Style from the Peloponnese one can single out works in Northern and South-Eastern Peloponnesian styles[323]. The period from 480 to 450 B.C., which was the era of the Severe Style in Greek plastics, was a peculiar period of "internationalism", a time of economic prosperity, when victory over the barbarians had aroused a certain feeling of national pride[324]. However, the trend towards a stylistic "*koine*" was accompanied by an opposite tendency in Greek art, namely for the es-

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[319] See: E.V. Chernenko, 1981, 87, 89.
[320] I. Kriseleit, 1980, 193-195, Abb. 2a-b.
[321] H.-M. von Kaenel, 1992, 35 ff., N 36, tav. VII-VIII, figs. 2-3 (with references); M.Yu. Treister, 1994, 87, fig. 4.
[322] M.Yu. Treister, 1994, 88-89; 1994b.
[323] R. Thomas, 1981; B. Barr-Sharrar, 1990, 215.
[324] B.S. Ridgway, 1970, 7, 69-70.

tablishment of various schools led by a single craftsmen in one locality or in one city-state. Craftsmen worked out their personal stylistic solutions, but took on pupils who did not always originate from the same centre[325]. However, the emerging schools of sculpture were closely associated with the traditions of artistic centres in which they had been established. For instance, P. Bol tries to see the artistic antecedents of Ageladas' creative work and even of those of Polyclitus in articles produced by Argive toreuts who had engraved shield overlays in the 7th-6th centuries B.C.[326].

Schools of prominent artists appeared in the Classical era. A significant role in their foundation may have been played by the succession of a master by his apprentice in the context of a single workshop, where a father gave the skills of his craft to his son[327]. For example, Ageladas, a sculptor from Argos, taught Myron, Polyclitus and Phidias (Plin. N.H. XXXIV. 55. 57)[328]. It is thought that Ageladas was the first Peloponnesian sculptor to begin using the technique of lost-wax hollow casting in the last quarter of the 6th century B.C., approximately a generation after craftsmen from Samos and Athens[329]. Myron's pupil was his own son; Polyclitus had seven apprentices, Pythagoras was a pupil of Klearchos-Alkamenas and Agorakritos were taught by Phidias[330]. The family tree of the pupils of Polyclitus included craftsmen from Sycion, Argos, and Isthmos[331]. Moreover the apprentices of Polyclitus included not only sculptors working in bronze and not even just sculptors. For example, one of them, probably Polyclitus II, was the architect of a tholos in Epidaurus (Paus. II. 27. 5). Polyclitus himself was like Phidias also a painter, and it was thus no mere chance that one of his pupils, Aristides of Thebes, became a prominent painter, whereas Euphranoros of Isthmos was both a sculptor and a painter[332]. Many of Polyclitus' pupils had their own apprentices[333], a fact which probably explains the long succession of Polyclitan images in the period that followed (fig. 35)[334].

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325 R. Thomas, 1981; D. Kreikenbom, 1990, 35-36.
326 P.C. Bol, 1990, 44.
327 H. Philipp, 1990, 91.
328 N. Kaiser, 1990.
329 P.C. Bol, 1990, 42-44.
330 B.S. Ridgway, 1981, 161-180; C.C. Mattusch, 1988, 216.
331 A. Linfert, 1990, 242. Taf. 2.
332 A. Linfert, 1990, 241.
333 A. Linfert, 1990, Taf. 2.
334 See: C. Maderna-Lauter, 1990; see about the statuettes of Polyclitan style: C. Rolley, 1986a, 164-166; A. Leibundgut, 1990; R. Thomas, 1992, 104 ff.

However the development of schools of sculpture in Greek art certainly reflected the process by which art craft came to be divided into craft proper and art. As a result of borrowings from their predecessors, sculptors introduced new features into their creative work, while solving new problems. As P.C. Bol said, if an artist is at all different from a craftsmen, *technites* from *banausa*, it is by his desire to make not a simple object, but a work of art, and then the first true artist in the history of art was probably Polyclitus[335].

In the Archaic epoch the bronzeworker, like the vase-painter, did not considered himself to be any lower than a sculptor or a painter. Archaic *techne* was changed by the narrow specialization of the Classical period, when the average standard of production was increasing, but at the same time the creative searching for solutions was becoming more limited. The Early Classical era saw the development of the mass copying of life-size statuary by various ateliers, which reflected the division between craft and art proper[336]. This was seen vividly in the descriptions of Herodotus, who very rarely mentions the names of craftsmen: it is worth noting that in the works of Euripides and Pindar, who could not themselves have enjoyed higher social standing than craftsmen and artists, craftsmen played even less significant roles. Herodotus understood by the term "*banausia*" the activity of craftsmen, which in other regions, for example, in the ancient Near East, was held to be of lower status than other occupations. For the first time this concept came to mean a single group shrunk in on itself, in contrast to the term "*demiurgos*", which earlier had commonly had a wider sense. It is hard to make any final decision as to whether Herodotus saw a clear difference between true "artists" and "craftsmen", although we cannot say that he saw no difference between them. Already taking the example of Corinth he saw that the negative view of the activity of craftsmen was not universally held. Anyhow, H. Philipp came to the conclusion that the age of Herodotus, in about the mid-5th century B.C., marked the beginning of a sharp differentiation between and within different professional groups. Aristophanes had already quite clearly distinguished craftsmen, whom he saw as little people, from artists, whose individual works he mentions. Little people included both smiths (Birds, 488 f.) and jewellers (Plutos, 617-618). Although his

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[335] P.C. Bol, 1985, 45.
[336] C. Rolley, 1986a, 154, 159.

view to them is coloured by nuances of comedy and deprecation, his attitude is in general positive, likening traders and peasants to little people, and contrasting diligent and assiduous people to sycophants. The origin of the generally negative view of craft work as a type of physical labour and the appearance of the term *banausos* was connected with the notion that a man who does not perform physical work is freed to devote himself to the state as a citizen. This idea which was first reflected by Xenophon (Oik. IV. 2-3; VI. 5) and Plato (Gorg. 518a; Polit. 371e, 372 a-d, 495d-496a, 590c) is expressed in its most extreme form by Aristotle (Pol. 1337b). This negative attitude which in the 4th century B.C. became a *communis opinio*, referred equally to the work of craftsmen and of artists[337].

In the city taken by Plato as a model for his "Laws", Magnesia, occupations like those of retail traders and craftsmen were considered to be unsuitable for citizens and were to be left to foreign residents. However the activities of the latter were subjected to the closest control, and they were normally to be deported after twenty years if not earlier (850bc; 915bc). Retail trade involves fraud and deceit: it must be limited to the lowest possible scale and minutely supervised; and even so citizens must be sheltered from the moral dangers it involves (918c-920c). Plato takes a more positive view of craftsmen, though he thinks it necessary to control with care their workmanship and remuneration (920d-921d). But no man, he says, can be master of more than one craft (a smith cannot also be a cobbler) (846d-847a). P. Brunt maintains that Plato is thinking only of craftsmen working alone or with perhaps a few assistants in small workshops, rather than of the owners of workshops who might possess managerial skills and could then efficiently control the manufacture of a range of products[338]. Not only may a citizen not personally engage in manufacture: he is also forbidden to employ any of his slaves for that purpose (846d).

Both sculptors and craftsmen enjoyed practically complete freedom. Their income was fairly high, although it fluctuated. They worked either for the *poleis* or tyrant or for private persons, but it was intended that they were available for public works, as long as they were connected either with temples or public buildings.

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[337] L. Neesen, 1989, 104 ff.; H. Philipp, 1990, 87-88, 98-100; P. Brunt, 1993a, 276-277.

[338] P. Brunt, 1993a, 263, note 59.

Problems of political relations, for instance between the native city of the sculptor and those who had given him a job played no role in the finalisation of a contract, although there certainly were exceptions. For example, in the late 5th century B.C. a founder called Strogylios worked for both Athens and Megara, whilst hostilities existed between the two. Thus, whether a craftsman enjoyed a settled life or changed his place of residence depended primarily on the character of his work (examples of influencing factors include large-scale socio-economic phenomena such as colonization or wars, which caused the movement of craftsmen, especially those living in small towns which could not furnish sufficient orders)[339].

### *3.2.3.5. Migrations of Craftsmen. Greek Craftsmen on the Periphery of the Classical World*

There is a peculiar phenomenon, whose causes may be explained by political factors—the conquest of the Greek regions of Asia Minor by the Persians and establishment on these territories of the satrapies of the Achaemenid Kingdom—namely the Greek workshops which were working there. They did not simply borrow the shapes of Achaemenid toreutics, but introduced a creative element to their development and played a definite role in diffusing the themes and motives of Achaemenid art over the toreutics and jewelry of the Early Hellenistic Mediterranean mainly via Macedonian workshops of the second half of the 4th century B.C.[340]. Probably the very fact that such workshops existed was connected with a degree of tolerance and the policy of inviting foreign craftsmen to the courts of the Achaemenid kings and satraps. I think that the conquest of Asia Minor by the Persians in 494 B.C. led to a considerably smaller wave of craftsmen forced into emigration (however, it did take place: see above the analysis of the statuette from Paestum by C. Rolley), than was the case a half-century before, which is reflected in various sources (vases, bronzes etc.; see above on p. 172)[341]. The practice of Ionian craftsmen working in the Achaemenid Kingdom goes back to the times of Cyrus II, when Ephesian architects were engaged during the building of the royal residence in Pasargade in 545-530 B.C. A bilingua found

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339 H. Philipp, 1990, 93-96.
340 B. Barr-Sharrar, 1984; 1986.
341 See also: H. Philipp, 1990, 96, 108, Anm. 186.

in 1970 shows that during the construction of palace of Darius at Susa Ionian and Lydian craftsmen worked as masons, while gold objects were made by Medeans and Egyptians. Besides dependent or independent Ionians the Early Achaemenids also offered shelter at their courts to Greeks who were ready to enter their service[342]. For example, on the evidence of Pliny (N.H.XXXIV. 68), a famous sculptor called Telephanos of Phocaea—he lived in Thessaly, had a reputation for the casting of bronze statues and was considered by fellow-artists to be the equal of Polyclitus, Myron and Pythagoras—served Xerxes and Darius[343]. There existed in Asia Minor an independent Asian Minor-Persian glyptic school[344]. Discussing gold rings of the 5th-4th century B.C., J. Boardman came to the conclusion that these are similar in style to Greco-Persian gems and thought that there could have been an independent centre for their manufacture located in Bactria[345]. Judging by analysis of some pieces from the Oxus Treasure, there was in Pre-Hellenistic Bactria a local goldworking centre, and in its workshops local craftsmen could have worked alongside craftsmen who had migrated or re-settled there from Ionia[346]. Plaster casts from Mit-Rahinet give an example of work of Greek craftsmen in an Eastern state (see above on p. 207). D. von Bothmer, who published a collection of silver vessels originating from Asia Minor, thought that they had been made by Ionian craftsmen for rich customers on the Eastern periphery of the Greek world[347]. However, the attribution of this group of vessels, which P.R.S. Moorey holds to be "Western Anatolian Achaemenid", is not above question, given the native Iranian tradition of gilding engravings on silver[348].

Recent analysis by M. Pfrommer seems to prove the existence of toreutic workshops, whose products combined Greek shapes with Egyptian and Achaemenid patterns. These were probably located in the 5th-4th centuries B.C. at the courts of the Achaemenid satraps in Asia Minor[349].

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[342] G.M.A. Richter, 1946; G. Goosens, 1949; V.G. Lukonin, 1977, 30; N.M. Nikulina, 1978, 38; H. Stierlin, 1986, 91; B. Funk, 1990, 9-12; S. Morris, 1992, 149; see most recently G.R. Tsetskhladze, 1994b, 99, note 77 with references.

[343] E.E. Kuz'mina, 1978, 191.

[344] P. Zazoff, 1983, 163-192.

[345] J. Boardman, 1970, 310-314.

[346] E.E. Kuz'mina, 1978; cf. the point of view expressed by B.Ya. Stavisskij (1978, 204-205).

[347] D. von Bothmer, 1984, 6.

[348] See: P.R. S. Moorey, 1988, 237-238.

[349] See: M. Pfrommer, 1990a, 208-209; 1993a.

In their turn Greek craftsmen borrowed techniques from Egyptian, Syrian and Iranian masters. As an example I shall mention the matrices from the workshop of Phidias at Olympia, used to shape glass which probably came from Syria, Palestine or Egypt; such techniques were hitherto unknown in Greece[350].

In the 4th century B.C. the number of itinerant craftsmen was growing. That was evidently due less to the smiths, who usually set up stationary workshops to meet the needs of a particular centre. However, craftsmen, who worked in precious materials and with unusual techniques, periodically faced the problem of finding new work[351]. What factors then influenced the mass migration of metalworkers?

1) Wars, the devastation of cities, and the economic decline which resulted from these. The crushing influence of the Peloponnesian War on the economy of mainland Greece led to migrations of craftsmen[352]. This can be traced through painted vases (the settlement patterns of Attic vase-painters)[353]. A. Burford thinks that the Peloponnesian War resulted in the interruption of temple construction both on mainland Greece and on the Greek Islands between 400 and 375 B.C.[354]. Study of techniques typical of the bronze workshop and smithy at Pantikapaion of the second-third thirds of the 4th century B.C. proves that an Attic craftsman probably worked here[355]. The most recent excavations have shown that the workshop would have been situated in a large building complex occupying the central part of the Western plateau of the city, probably in the palace of the Spartokids[356]. Judging by the character of the debris, the workshop was in use for some decades at least, and cannot thus be considered to have been temporary. Thus, in this period there were typical migrations of craftsmen, who were usually working in stationary workshops, and were thus not as mobile as the sculptors or founders of statues.

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[350] W. Schiering, 1988; 1991, 139: "Wenn das Glas in Barren aus dem ägyptisch-palästinensischen Raum importiert worden ist, liegt es nahe, dass auch künstlerische und vor allem technische Ideen und Anregungen von dort nach Griechenland gelangt sind. Deshalb darf man hoffen, dass weitere technische Auskünfte auch noch aus diesem Gebiet zu erwarten sind".

[351] A. Burford, 1969, 32-34; P. McKechnie, 1989, 143-144.

[352] S. Mrozek, 1989, 51.

[353] B.R. Macdonald, 1981.

[354] A. Burford, 1969, 32-34.

[355] M.Yu. Treister, 1987a, 8-12; 1988, 155-156.

[356] V.P. Tolstikov, 1989.

2) Emergency programmes for the mass construction of ships, or for the manufacturing of arms and cuirasses. Whereas such programmes were rather rare in the 5th century B.C. (the building of a fleet by Themistocles), they became much more frequent at the beginning of the following century. Thus, with the migration of 399 B.C. a stream of armourers flowed to Syracuse, and some years later to Ephesus. It is thought that in both cases a considerable number of armourers went first to Sicily and then to Asia Minor from Athens[357].

The recruitment of craftsmen and artists—including metalworkers and sculptors—and thus the establishment of temporary workshops were clearly influenced by public building programmes. For example, craftsmen were invited to come to Athens at the time of Pericles, who had initiated a programme to reconstruct the Athenian Acropolis at the expense of the Confederacy of Delos[358]. According to various reckonings, the cost of constructing the Parthenon alone was from 470 to 800 talents[359]. Among the more important expenses incurred during these building programmes were the costs of acquiring the metal used for details of the construction and for the decoration of reliefs. For example, during the building of the Parthenon work in gold and silver was paid for in the ninth year of construction, in 439/8 B.C., whereas unused stocks of gold were sold in the following year[360]. 44 talents of gold were spent on the chryselephantine statue of Athena by Phidias[361], although earlier it had been thought that the sum was equal to 83 talents[362]. It is interesting to note how widely precious metals were used in the decoration of architectural monuments, for instance gold foil for the decoration of the capitals of the Erechteion[363].

The tradition of inviting sculptors and bronze founders to come to carry out a given commission had been established in the late 6th century B.C. when Athens invited Antenor to come to cast the statues of Harmodios and Aristogeiton. Pliny mentioned that this practice was later on in common use (N.H. XXXIV. 17). It is

[357] P. McKechnie, 1989, 144.
[358] A. Wittenburg, 1978, 5-25; J. Walsh, 1986; W. Schmitz, 1988, 70-75; A. French, 1991, 35-36.
[359] See: V.D. Kuznetsov, 1990, 39, note 71.
[360] A. Burford, 1963, 31.
[361] A. Wittenburg, 1978, 45-50; P.C. Bol, 1985, 109.
[362] W.B. Dinsmoor, 1921, 127-128.
[363] E.M. Stern, 1988.

logical to assume that sculptors and founders would have usually worked not far from the place at which the statue was to be installed. That this was the case is shown by the remains of the temporary workshops of sculptors and of casting pits situated near temples and public buildings which have been excavated at Athens, Corinth, Nemea and other centres[364]. At the same time other ideas have been put forward. For example, H. Philipp see two possibilities: either a statue, made to the order of another poleis, was cast in the sculptor's atelier and then sent on, or part moulds made from a model or the cast separate parts of the statue could have been sent to the place where the statue was to be set up; after that the statue was cast or assembled under the direction of the craftsman himself[365].

After a pericd of decay caused by the Peloponnesian War and its aftermath large-scale works were initiated in various regions of Greece from about 375 B.C., for example the construction of a tholos at Epidaurus or the mausoleum at Halicarnassus. However, the mobility of craftsmen was as a rule rather restricted. For example, outsiders from Athens, Argos, and Corinth were employed in the construction of the Epidaurian tholos, while metalworkers working on the simplest orders worked permanently in Epidaurus. They were the most influential craftsmen and not only manufactured in their workshops the metal details necessary for the building, but also supplied them. It is certainly the case that sculptors were distinguished by their greater mobility[366]. Inscription IG II$^2$, 1498-1501A, an inventory list of bronze statues compiled by the treasurers of Athena, is associated with the reorganization of the Athenian Acropolis proposed by Lycurgus in 335 B.C. Lycurgus also commissioned sculptors to create new statues, the most famous of which was the portrait of Socrates by Lysippos (Diog. Laert. II. 43). As D. Harris thought, the statues listed in the IG II$^2$, 1498-1501A were most probably inventoried in response to the legislation of Lycurgus. They were to be melted down as part of the reorganization of the Acropolis and their bronze was to be reused in new works of art to be dedicated to Athena[367].

The *ethnikon* "*Athenaios*" is engraved on numerous statue bases from various regions of the Mediterranean and Pontic areas[368].

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[364] M.Yu. Treister, 1984a; G. Zimmer, 1990, S. 156-159.
[365] H. Philipp, 1990, 96.
[366] A. Burford, 1969, 32; 1974, 63; P. McKechnie, 1989, 145-146.
[367] See below note 373.

Among these are some bases of the 4th century B.C.[369]. Attic sculptors were no exception[370]. During his life a Greek sculptor of the 5th-4th century B.C. would as a rule cast no more than 50 sculptures, although ancient writers usually mention no more than 10 and rarely 20 statues—these were masterpieces (Pythagoras—15, Myron—24, Phidias, Polyclitus—20)[371]. Pliny (N.H. XXXIV. 36) mentioned almost thirty sculptors of the 5th century B.C., who worked in bronze, and stated that in his time about 3000 sculptures were known in Rhodes and a similar quantity in Delphi, Athens and Olympia[372]. The preserved part of an inventory of bronze statues outside the temples of the Athenian Acropolis compiled in ca. 330 B.C. mentioned no less than 32 figures. It is evident that there were in fact many more because the largest part of marble stele bearing the text of the inventory has not been preserved[373].

One of the most attractive centres for Greek sculptors and founders was Olympia, and here in 544 B.C. began the tradition of erecting statues of the winners in the Games (Paus. VI. 18. 7). Originally they were carved of wood, but later were usually cast in bronze. However, travelling in Greece in the 2nd century A.D. Pausanius mentioned more than ten bronze statues at Delphi, more than sixty in Athens, forty at the temple of Zeus at Olympia and hundreds of statues of Olympic winners. It is thought that at the time of Pausanius' visit to Olympia there were about 1000 statues[374]. The earliest known bronze portrait sculpture may be a head found at the sanctuary of Apollo at Cyrene, which is probably a portrait of the last representative of the local Battiad dynasty, Arkesilas IV, and is dated to the mid-5th century B.C. The bronze head of the "Philosopher" from the shipwreck near Porticello may also be a portrait; various scholars date it to between 460 and 430 B.C., although it could belong to a centaur, as B.S. Ridgway suggests, which originated from Magna Graecia or

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368 E. Loewy, 1885, N 41-42, 83, 103a, 108-112; C. Blinkenberg, 1941, N 86, 90, 102, 103; J. Marcadé, 1953, N 89, 91.

369 E. Loewy, 1885, N 76, 76a, 127, 127a, 146; C. Blinkenberg, 1941, N 29-30, 43; J. Marcadé, 1953, N 7; *Nadpisi Ol'vii*, 1965, N 65.

370 E. Loewy, 1885, N 12, 23-24, 61, 61a, 258, 89, 95, 96, 103, 121, 122, 122a; C. Blinkenberg, 1941, N 74, 89, 100 etc.; M.Yu. Treister, 1988, 156.

371 P.C. Bol, 1985, 164-165, 208, Anm. 155.

372 See: C.C. Mattusch, 1988, 139-150, 186-196.

373 IG II$^2$, 1498-1501; D. Harris, 1991, 296; 1992.

374 P.C. Bol, 1985, 177-178; C.C. Mattusch, 1988, 99-100, 108-109; H.-V. Herrmann, 1988.

North Africa[375]. Much more complicated is the attribution, identification and dating of the bronze statues of warriors from Riace. They were thought to be of Attic workmanship, though South Italian origin was not excluded. Some scholars think that the statues were cast in a single workshop, others hold that they were the work of a single artist or of various artists. The names of Onatos, Myron, Phidias, the school of Phidias, Polyclitus and his successors have been mentioned. Most scholars have dated the statues to 460-450 B.C. onwards, although later datings (from 100 B.C. to the Hadrian era) have been suggested as well. In cases in which it has been suggested that these sculptures were cast by various artists, statue A is usually dated to 460-450 B.C., and statue B to 30 years later. The figures have been identified as heroes, generals and hoplitodroms. The hypothesis that they were manufactured in the same workshop assumes that both statues belonged to the same monument: the sculptural groups considered include an Athenian dedication at Delphi in honour of the victory at Marathon including statues of Athena, Apollo, Miltiades and eponymous heroes; an Achaean dedication at Olympia containing the figures of Greek heroes preparing for battle with Hector and a monument to eponymous heroes from the Athenian Agora[376].

4) Temple orders. Craftsmen who manufactured precious vessels for temple treasuries could also expect to be invited to come to work on site, as happened, for instance, in the 330s B.C. when toreuts from Corinth, Athens and other centres were invited to come to Delphi[377].

It is known from IG II$^2$, 333, dated to 335/4 B.C., that Lycurgus hired artisans to fashion new ritual vases and utensils for the various sanctuaries of Attica[378].

### *3.2.3.6. Oriental Craftsmen in Greek Workshops?*

There are reasons to suppose that the custom of Oriental metalworkers working in Greek workshops—known from the Geometric period—was at least occasionally repeated in Classical times.

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[375] C. Rolley, 1986a, 48-49, fig. 21; C.J. Eiseman, B.S. Ridgway, 1987; C.C. Mattusch, 1988, 196-199.

[376] See the survey of various points of view in the official publication: *Due Bronzi de Riace*, 1985; see also : C. Rolley, 1986a, 44-48; C.C. Mattusch, 1988, 200-211.

[377] D.M. Lewis, 1986, 78.

[378] D. Harris, 1992, 642, note 19.

This is proved by the passage from Diodorus mentioned above (XIV.41) that Dionysius "... gathered skilled workmen commandeering them from the cities under his control and attracting them by high wages from Italy and Greece as well as Carthaginian territory".

### *3.2.3.7. Wandering Barbarian Craftsmen in the Greek World?*

In 1967 in a tumulus near stanitsa Ivanovskya in the basin of the Kuban river various stamped sewn gold plaques were found, including some in the shape of a standing figure of Heracles, a head of the Gorgon, a female head in profile, a snake-legged goddess, and a butterfly, dated to the 4th century B.C.[379]. Among other plaques four pieces were found in the shape of a male face 2.4 cm high[380]. As far as I know, this type of plaque has no analogies among the numerous gold plaques of the North Pontic area. One can find quite unexpected parallels in the Early Celtic art of the 5th-4th century B.C.[381].

In the case discussed above it is impossible to imagine that the motif developed in parallel both in Bosporan (or Scythian?, Maiotian?[382]) and Celtic art. One should therefore address the possibility either that there was direct contact between these peoples, or that Early Celtic ornaments or utensils found their way into such an out-of-the-way area. For the first half of the 4th century B.C. it is rather difficult to speak about any direct contact between the Celts and the Bosporan Kingdom or its surroundings. Till today the earliest data supporting the idea of contact between the Celtic civilization and the Bosporan Kingdom comes from the second quarter or the middle of the 3rd century B.C. (a representation of Galatian-type shields on a fresco from Nymphaion and Galatian shields and pseudo-anthropomorphic daggers on coins of Leucon II)[383].

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379 *Art Treasures*, 1987, N 81-87; 111, fig. 38; N.V. Anfimov, 1987, 169; *Gold und Kunsthandwerk*, 1989, 117-119, N 81-87, Abb. 35; *The Treasures of Nomadic Tribes*, 1991, N 41-46.

380 *Art Treasures*, 1987, N 83; N.V. Anfimov, 1987, 169, *Gold und Kunsthandwerk*, 1989, N 83; *The Treasures of Nomadic Tribes*, 1991, N 44; kept in Krasnodar State Historico-Archaeological Museum, F2, N 206-209.

381 The parallels are discussed in a special article: M.Yu. Treister, in print-3.

382 See the finds of bronze stamps for embossing of gold foil plaques in the 4th century B.C. burial at Ulyap in Kuban river basin: A. Leskov, 1990, Kat. 131-132, Abb. 92-95.

383 See: M.Yu. Treister, 1993a, 789-790, fig. 1. Besides, bronze coins, such a

One possibility for a direct connection at a time long before the Celtic expansion into the West would have been via Celtic mercenaries. The earliest data showing that Celtic soldiers served in the Mediterranean goes back to 368 B.C., when Dionysius I of Syracuse sent a contingent to help the Lakedemonians against Theban troops (Xen. Hell. VII.1.20-22; Diod. XV.70; Justin XX.5)[384]. We thus know that the numbers of Celtic warriors involved was quite considerable (2000, including Iberians), that they proved to possess "the superior dexterity and courage" and not only defeated the Thebans, but also the Sicyonian army. It seems likely that the same mercenaries were sent in the following year under Cissidas to the Isthmos to assist the defenders of the King's Peace[385].

Dionysius may have established contacts with the Celts even earlier, in the 380s B.C. B. Caven associates the need for mercenaries, the Celts, with Dionysius' desire to build up a maritime empire in the Adriatic to counter that of Carthage in the Western Mediterranean and he suggests that either Dionysius' agents made a contract with the Senones, a Celtic tribe which descended upon central Italy in 391 and sacked Rome in the following year, or, more likely, that the Celts entered into a treaty with Dionysius as a result of the establishment of Syracusan colonies in the Adriatic[386]. Dionysius had strengthened his army with Gauls in his war against Carthage in 379 B.C.[387].

According to ancient literary tradition, the Celts had penetrated into Italy just before engaging in battle with the Etruscans and finally besieging Rome in 387 B.C. (Poly b.i II. 17 ff; Livy V. 34 ff). There is much archaeological data to demonstrate the presence of Celts in Northern Italy[388]. G. Dobesch recently concluded that the Celts had penetrated into Northern Italy in the

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dagger as an additional emblem appears on a gold coin of Leucon II (the piece from collection of W. Stancomb, London). The author is grateful to W. Stancomb for the possibility to study the coin.

384 See also: G.T. Griffiths, 1935, 195, 239; K.F. Stroheker, 1958, 143, 155-156; H.W. Parke, 1970, 88-89; O.-H. Frey, 1985, 234, Anm. 11; P. Cartledge, 1987, 386f.; H.D. Rankin, 1987, 45; P. McKechnie, 1990, 82; I. Wernicke, 1991, 24, 163, Anm. 95.

385 B. Caven, 1990, 205; K.F. Stroheker (1958, 144) suggested, that these were the new Celtic and Iberian troops.

386 K.F. Stroheker, 1958, 119, 125; B. Caven, 1990, 150-151; see about Dionysius' negotiations with Celts: Justin. Hist. XX.5.4-6.

387 B. Caven, 1990, 195.

388 See, e.g.: V. Kruta, 1978; P. Stary, 1988, 71; see bibliography: G. Dobesch, 1992, 177, Anm. 50.

period between 430 and 400 B.C.[389]. At present, the reconstruction of ancient testimonia in conjunction with archaeological materials provides several reasons to suggest that the process of Celtic penetration in Italy should better be described as "infiltration" and that it took place gradually in course of the 5th century B.C. The first Celtic tribes may have already penetrated into Padana in the 6th century B.C.[390]. Besides this, finds of Greek luxury articles in early La Tène burials suggest that alongside trade relations there were already political relations between Celts, Etruscans and Greeks in the 6th-5th centuries B.C. This is for instance proved by a passage from Livy (V. 34. 7f.) referring to the help rendered by the Gauls to the Phocaeans during the foundation of Massalia[391].

Thus, the employment of Celts as mercenaries in at least the first half of the 4th century B.C., if not earlier, made it possible that there were direct contacts between the Celts and Greeks of various origins, as well as Scythians, who are known to have already taken service in Athens in the 5th century B.C.[392]. There is thus some possibility that there were contacts with Black Sea Greeks. One mercenary from this area is mentioned in an Athenian inscription of the late 4th century B.C.[393]. In 310 B.C. Greek mercenaries became involved in a dynastic struggle in the Bosporan Kingdom, in which following the death of Pairysades, his sons Eumelus, Satyrus and Prytanis engaged in a struggle one with the other for primacy. In the army of Satyrus "were not more than two thousand Greek mercenaries and an equal number of Thracians, but all the rest were Scythian allies.." (Diod. XX. 22 sq.)[394]. One cannot rule out the earlier use of mercenaries in the Kingdom of Bosporus.

Dionysius recruited workmen from the same countries as he did his warriors, and he realized the value of a diversity of specialized arms and the importance of regular training. "After collecting many skilled workmen, he divided them into groups in accordance with their skills, and appointed over them the most conspicuous citizens, offering great bounties to any who created a supply of arms. As for the armour, he distributed among them

[389] G. Dobesch, 1992, 163, 177.
[390] I. Wernicke, 1991, 94-96, 110-113.
[391] F. Fischer, 1973, 436-459; I. Wernicke, 1991, 70-71.
[392] G.T. Griffiths, 1935, 238; cf. B.M. Lavelle, 1992, 78-97, esp. 80, note 10, 87f.
[393] IG II$^2$ 1956; G.T. Griffiths, 1935, 240.
[394] G.T. Griffiths, 1935, 240.

models of each kind, because he had gathered his mercenaries from many nations; for he was eager to have every one of his soldiers armed with the weapons of his people, conceiving that by such armour his army would, for this very reason, cause great consternation, and that in battle all of his soldiers would fight to best effect in armour to which they were accustomed" (Diod. XIV.41.4-5) (transl. by C.H. Oldfather). H.W. Parke suggested: "So each workman was to make the weapons of his own nation for the soldiers of his own nation; and the mercenary, whatever his origin, could be armed with his native weapons"[395]. Another opinion was recently put forward by P. McKechnie, who considered that Dionysius' "barbarian mercenaries cannot necessarily be assumed to have joined him on what Greeks might have considered the usual terms, so the fact of his making armour for them may seem of little significance for present purposes; but the list of the arms not only shows the enormous scale of the programme, it also implies that the bulk of it was concerned with producing Hellenic arms"[396]. The passage from Diodorus does not provide any direct evidence that Celtic craftsmen were also there. Yet Dionysius, by distributing models of each kind of weapon, gave the opportunity to the Greek and Italic craftsmen whom he had recruited ("he gathered skilled workmen, commandeering them from the cities under his control and attracting them by high wages from Italy and Greece as well as Carthaginian territory" (Diod. XIV. 41.3) (transl. by C.H. Oldfather) of reproducing the arms of various peoples, and very probably also Celtic arms, as he employed Celts as mercenaries. Besides, Celtic metalworkers of the Early La Tène period were very skilful craftsmen who imitated imported Etruscan and Greek luxury articles[397]. There are reasons for suggesting that itinerant Greek craftsmen worked for the high Celtic aristocracy (see above the suggestion concerning the transportation of the Vix krater). A mould for casting situla attachments with a Silene head and a palmette, dating to the 5th century B.C. and found during excavations of a Celtic oppidum at Heuneburg, may have belonged to a Greek or Etruscan craftsmen working for the Celts. However, according to W. Kimmig, the piece was most probably used by a Celtic master who had learned his skills in one

[395] H.W. Parke, 1970, 68-69.
[396] P. McKechnie, 1990, 82-83.
[397] See, e.g. D. Timpe, 1981, 45-47 about goldworking.

of the Classical centres[398]. This possibility is not excluded by R. and V. Megaw[399]. That Celts were goldworkers is proved by passages from various ancient writers (Polyb. II. 17. 11). Especially important is the description of Celtic warriors at the battle of Telamon in 225 B.C. "all in the leading companies richly adorned with gold torques and armlets" (Polyb. II. 29. 8) (transl. by R.W. Paton)[400]. All these observations prove that itinerant Celtic goldsmiths could have been present among the Celtic mercenaries employed by the Greeks.

Thus the gold plaques in shape of a male face found in the Kuban river basin would seem to have been made following an Early La Tène prototype. It seems that this may have found its way either to the Kingdom of Bosporus, or directly to the area in which the plaques were found. This was not then as the result of earlier contacts (of the late 6th-early 5th century B.C.) between the Northern Pontic area and Central and Western Europe, but rather the result of Celtic infiltration of the 5th-4th centuries B.C. into Italy, where they were employed as mercenaries from at least the first half of the 4th century B.C. The general use of mercenaries in Greek armies probably meant that soldiers, even barbarians, found their way with their own equipment and ornaments to distant parts of the oikumene.

### *3.3.1. Prices of Metals*

There are epigraphical documents which mention the prices of some metals. For example in an inscription containing the annual report for 421/20 B.C. of expenditure on the statue of Athena Promachos, there is—to judge by the reconstruction by A. Raubitschek—a reference to the purchase of 150 talents of tin costing 34852 drachms, the price of talent thus being approximately 233 drachms. In the same inscription there is mention of the purchase of 37 talents of copper for a price of 1301 drachms and 6 obols: this presupposes a price for one talent of copper of 35 drachms 1 obol[401]. Such a difference in price between tin and

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[398] W. Kimmig, 1972, 349-350.
[399] R. and V. Megaw, 1990, 54.
[400] D. Timpe, 1981, 46; I. Wernicke, 1991, 138-139.
[401] IG I$^3$, 472; A.E. Raubitschek, 1943, 14-17; E.B. Harrison, 1977, 144; G. Zimmer, 1985, 46; C.C. Mattusch, 1988, 171; D. Haynes, 1992, 84-85.

copper (more than in 6.5 times) was profitable to the suppliers of bronze who were interested in economising on the more expensive material in the process of alloying. This fact is thought to be the reason behind the inclusion of a specification of the alloy in a text carved on a stele dealing with the construction of the Philo Stoa at Eleusis of ca. mid-4th century B.C. (the alloy being that of the metal fittings for the column drums)[402].

Following the find in 1980 off the coast of Israel of a bronze ram it was thought that accounts from the Athenian shipyard dated to 325/4 and 323/2 B.C. about the sale of old damaged rams as metal scrap would have to be reconsidered. The weight of this unique find is 465 kg; however, for a century it had been supposed that trireme rams had a weight of ca. 77 kg[403]. Inscription IG II$^2$, 1629 refers to the sale of probably 5 rams having total weight of more than 3 talents (the number is partly preserved) for 524 drachms. Inscription IG II$^2$, 1631 mentions the sale of further 5 rams, however it preserves neither their total weight nor the price paid[404]. On the basis of the price of metals known from inscription IG II$^2$, 1675, W.M. Murray has reconstructed the cost of one talent of bronze as 60 drachms and 1.5 obols[405]. The quoted price of one talent of bronze corresponds approximately to the probable reconstruction of the total weight of a ram in inscriptions IG II$^2$, 1629 and 1631[406].

However the calculations given here cannot be considered correct if one considers that the symbols cast in relief on the ram, namely a *kyrikeion*, the head of an eagle, a flash, a *pilos* crowned with eight-rayed star, could only have been used together in one place and in one given period: in Cyprus in the time of Ptolemy V Epiphanes (204-181 B.C.). Thus, it is necessary to acknowledge that the ram found near Athlit had most probably been cast on Cyprus in the period mentioned above and designed for a Ptolemaic warship based on the island, perhaps in the bay of Paphos.

The ship was comparatively small in relation to the large class of ships used a century later at the battle of Actium[407]. The case

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402 IG II$^2$, 1675; K. Jeppesen, 1958, 145; G.J. Varoufakis, 1975; G. Zimmer, 1985, 45.

403 H. Frost, 1982; W.M. Murray, 1985.

404 W.M. Murray, 1985, 142-143.

405 W.M. Murray, 1985, 144.

406 W.M. Murray, 1985, 145-150.

407 E. Linder, 1988; W.M. Murray, 1986, 192. See also the special publication

for a new date and attribution for the Athlit ram is given by analysis of a marble monument in shape of ship prora from Cyrene[408]. In this case if one considers the weight of Attic trireme rams to be 77 kg (see above on p. 140), the price of one talent of bronze would be approximately six times higher (ca. 361 drachms) and thus even more than the price of a talent of tin, though this reconstruction is based on an inscription of approximately a century earlier. A more acceptable figure emerges if the weight of Attic trireme ram is considered to be 200 kg[409]. We should thus resist calculating the price of bronze in Athens according to the method proposed by W.M. Murray[410].

The building accounts of Epidaurus contain information about the prices of iron. For example in the accounts of Phimela dating from 365-335 B.C. there is mention of supplies of iron cramps which were received according to weight, approximately at the price of 14 drachms and 2 obols for one talent[411]. In one of the mid-4th century B.C. Delphic inscriptions there is reference to a certain Nikodamos of Argos, who had hammered 2 iron cramps each weighing 6 minas for a price of 3 obols for one mina, and to another smith, Kairos, who had completed an unknown number of cramps weighing 7 minas each for the same tariff[412]. Given the simplicity of this kind of article, one could infer that the price of iron was somewhat lower. The price of cramps for the capitals made by Kleudamos of Delphi was a little higher[413]. However, it could also be lower. For instance, a cooperative feat of manufacture of a thousand iron cramps and clamps together weighing almost 10 tons and mentioned in one of the Delphic inscriptions was priced at one and a quarter obols for one mina of iron[414].

Lead was cheaper than copper and tin. For instance, it is known from Epidaurian inscriptions that a certain Euremonos received 18 drachms 4.5 obols for 6 talents and 37 minas of lead[415]. Thus, the price of one talent of lead was 2 drachms and 5 obols. A. Burford states that the price of lead varied from 1 drachm 3

devoted to that unique find: E. Linder, 1991, esp. 66, 72-75 and the review by C. Rolley (1993, 398-399).

408 B.S. Ridgway, 1990, 217.

409 J.S. Morrison, J.F. Coates, 1986, 168-169.

410 W.M. Murray, 1985.

411 IG IV$^2$, 103; A. Burford, 1969; V.D. Kuznetsov, 1986, 45.

412 J. Bousquet, 1989, 93, N 49B.

413 J. Bousquet, 1989, 98, N 53.

414 J. Bousquet, 1989, 112-133, N 59.

415 V.D. Kuznetsov, 1986, 45.

obols to 3 drachms for a talent and increased twofold over seven years[416]. Contemporary prices of lead are known for the mid-4th century B.C. from Delphi. For example, one of the inscriptions found there is mentions the sale of more than 10 tons of lead at a price of two and a half or three drachms to the talent[417].

When in 478/7 B.C. Aristeides established the rate of dues to the treasury of the Confederacy of Delos, he took as his basis a ratio of gold to silver of 1: 15.66, which was not the exchange rate of gold to silver coinage that existed in the Persian Empire (in the Persian bi-metal coin system a gold darik was exchangeable for silver sigloi at a rate of 1: 13.33), but the correlation of the prices of gold and silver in ingot form[418]. Over time the ratio of gold to silver was falling.

The ratio of gold and silver can be reconstructed with a fair degree of certainty on the basis of an *epistatai* inscription and wreath dedications in the treasury of Athena from the period of 434-348 B.C. It had been 1:14 in the time of the Archidamian War, but it sank a little in the time of the Peace of Nicias and after that fell considerably during the Sicilian expedition[419].

At the same time in Sicily in the late 5th-early 4th century B.C., the weights and the correlation of gold to silver in the coinage of four centres: Syracuse, Acragas, Gela and Camarina, indicate that the gold-silver exchange rate was at first 1:13 but that later, according to C.Boehringer, at the beginning of 405 B.C., when Dionysius came to power, it grew to 1:15[420]. In Athens in 402 B.C., following data provided by D.M. Lewis, it was perhaps lower than 1:11. It gradually returned to the rate reached in the early 360-s 1:12 and later on fell to 1:11. It is thought that the conquest of gold mines and the emission of coinage by Philip II of Macedon led to a further reduction to 1:10 in 348 B.C.[421]. According to other data[422], this change of rate of gold to silver may be followed in detail by analysis of inscriptions of Athenian inventories between 370/69 and 355/4 B.C. One sees this same tendency for it to reduce from 1:13.36 in 370/69 B.C. to 1:12.05 in 357/6-355/4 B.C. It was not a steady reduction, but fell in stages: in 368/7 B.C.,

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416 A. Burford, 1969, 181.
417 J. BousquetJ. , 1988, 127-128, N 31; 1989, 110, N 58.
418 J.P. Guepin, 1979, 218.
419 D.M. Lewis, 1968.
420 C. Boehringer, 1979, 16-17.
421 D.M. Lewis, 1968.
422 P. Marchetti, 1987, 146.

when the ratio was 1:12.85, then down again in 364/3 (1:12.65), in 361/0 (1:12.35) and in 357/6 B.C. (1:12.05).

The price of any metal may have been influenced by various factors linked both to its quality and to its relative accessibility and expense; the price could however vary slightly due some temporary shortage. In some cases in the period under discussion traders had deliberately engineered it. An odd example is cited by Aristotle in the "Politics": "In Sicily, a man used some money deposited with him to buy all the iron from the iron foundries, and when traders came from their trading places he alone had it to sell; and though he did not greatly increase the price, he made a hundred talents' profit out of an original fifty. When Dionysius heard of this, he ordered him to take his funds and leave Syracuse, on the grounds that he had discovered a way of raising revenue that was harmful to Dionysius' own affairs" (Arist. Pol. 1259a1). V.N. Andreev thought that this was a typical example of a scheme, the art of exploiting an opportunity, and distinguished it from capitalist monopoly, which was achieved through competition[423]. Pseudo-Aristotelian "Oeconomica" (1253a) mentions that Pythocles proposed to the Athenians that the city buy lead from private persons for 2 drachms and later sell it for 6 drachms[424].

### *3.3.2. Trade in Metals*

Some Greek centres struck coins using metal from mines which they owned, others had to use imported metal. Identification of metal sources in the Classical period remains rather hypothetical. As E. Will has stated, Aegina had received silver from Siphnos and Corinth from Illyria, while the cities of Magna Graecia were dependent on Phoenician or Etruscan supplies.[425] However, recent studies seem to indicate that in the 4th century B.C. Southern Italian silver coins were struck of metal which had originated in the mines of Calabria[426].

The remains of the ship found in the strait of Messena near to Porticello and dated to ca. 400 B.C. or 430-425 B.C. or ca. 387

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[423] V.N. Andreev, 1983, 19; see also: R.J. Forbes, 1964a, 263; T.J. Figueira, 1984, 22-23.

[424] B.A. van Groningen, 1933, 200-201; B.A. van Groningen, A. Wartelle, 1968, N 36; A. Burford, 1969, 181.

[425] E. Will, 1975, 98.

[426] *Navies and Commerce*, 1988, 500 (T.Hackens, discussion).

B.C.[427] contained a mixed cargo which was found to include lead ingots each of ca. 25.7 kg (archaeologists recovered only two pieces, but it is known that more than 20 ingots were found by fishermen and sold as scrap metal). C.J. Eiseman points out that an ingot of a similar shape was found at Laurion in the 19th century and is presently preserved in the local museum. Finds from the southern coast of France (Saint-Tropez and Agde) are contemporary in shape yet differ from Roman ingots. The authors of the publication have made an attempt to decipher the letters engraved on one of the ingots. If these designate its weight—101 staters—then the ingot would have to weigh 92.745 kg, which is much more then its actual weight. Without interpreting the inscription (the hypothesis is put forward that it could be the name of the mine or workshop where the ingot was cast), C.J. Eiseman thinks that the weight of the lead ingot was equal to one talent (such measures of lead are mentioned in inscriptions from the Erechteion) or *krateutes* (see the inscription from the Hephaisteion, IG I$^2$, 370-371). Analysis of lead isotopes shows that the metal very probably originated from the mines of Laurion[428]. Some scholars rightly state that a find of lead ingots from Porticello raises many questions; in particular, why had ingots of Laurion lead been brought to the west in a period in which the Laurion mines had been exhausted. Does this mean that the lead-silver mines of Spain, as C.J. Eiseman thinks, were under Phoenician control and that as a result metal from Spain was more expensive? However if D.W. Gill is right in thinking that the Porticello shipwreck has an earlier date then the discrepancy with the chronology of mining at Laurion disapppears[429]. Thus in addition to M.I. Finley's statement that silver was the major Athenian resource, which was exported both as ingots and as coins[430], or, as R.J. Hopper suggested[431], at least covered the costs of importing grain, wood and other raw materials into Athens, one can suppose that trade in lead ingots was a specific element of Athenian exports. The remains of the vessel's cargo were found to include fragments of bronze sculptures, including the famous head of the

427 C.J. Eiseman, B.S. Ridgway, 1987; cf. D.W. Gill, 1987a; J. Boardman, 1988; cf. R.R. Holloway, 1988, 65; A.J. Parker, 1992, N 879 with references (ca. 425-400 B.C.?).

428 C.J. Eiseman, 1980; C.J. Eiseman, B.S. Ridgway, 1987, 53-60.

429 M.Yu. Treister, 1991, 235-236; 1992, 32.

430 M.I. Finley, 1985, 134.

431 R.J. Hopper, 1979, 48.

"Philosopher", which, in my view, were transported as scrap metal[432].

Tin ingots of the 5th-3rd century B.C. have been recovered off the coast of Israel. They include an ingot bearing letters from Iberian alphabets and a relief image of the head of Arethusa comparable to emblems on coins of Syracuse dated to the 470s B.C. The author of the publication says that it would be too rash to ascribe the ingots found near Haifa unconditionally to Iberian mines, because no metal analysis was undertaken[433].

The victory of the Syracusan tyrant Gelon over the Carthaginians gave him the right to 2000 Carthaginian slaves and to a tribute of 2000 talents annually[434], which, according to C.Kraay, allowed him to strike heavier coins. On his calculations, 2000 talents of silver was sufficient for the minting of 3 million tetradrachms, which can be struck with ca. 300 dies, but this is twice as many as have been identified to date[435]. Undoubtedly, as R.R. Holloway thinks, war was the main reason for such mass coining, however even allowing for the annexation of new territories and for increased income from Carthaginian tribute and other revenues from confiscations, it is hard to believe that Syracuse's supply of silver grew so much that it was possible to mint ten times as many coins as before (the methods of calculations used by R.R. Holloway and C.M. Kraay differ from one other). Evidently, the whole tax basis of the state widened, bringing considerably higher amounts of precious metals from Syracusan territories into the treasury of the Deipomenides[436]. M. Arzty thinks that Gelon may as a result of a victory have also obtained the right to exploit tin mines and to transport metal. He thus suggests that the ingots were most probably cast somewhere in the Western Mediterranean in ca. 476 B.C.[437] However the hypothesis put forward by M. Arzty needs further justification, especially given the recent theory that the battle of Himera was part of a "private" war waged

[432] See: R.R. Holloway, 1988, 65; M.Yu. Treister, 1991, 237-238; 1992, 32.

[433] M. Arzty, 1983; E. Galili, 1986, 6.

[434] See about the battle near Himera and its sequels: H. Bengtson, 1975, N 131; L.M. Hans, 1983, 51-52; A.K. Burn, 1984, 476-487; W. Huss, 1985, 93-99; P. Barceló, 1988, 156-161; M. Zahrnt, 1993; cf. W. Ameling, 1993, 15-50.

[435] C.M. Kraay, 1969, 30; cf. H.B. Mattingly, 1992, 1 ff. with references, note 1; cf. M. Zahrnt, 1993, 360, 368.

[436] R.R. Holloway, 1987, 11-15. See also R. Krumeich, 1991; M. Zahrnt, 1993, 361-368.

[437] M. Arzty, 1983; M.Yu. Treister, 1992, 32.

by Hamilkar and that his defeat had no serious economic consequences for Carthage[438].

The cargo of a vessel found near the island of Plane in the bay of Marseilles included amphoras from Massalia, Carthage, Chios, and Magna Graecia, Attic black-glazed skythoi and a lamp as well as copper ingots, which apparently constituted the main cargo of the ship. About 60 of them were salvaged. They are pebble-shaped, with much variation in size and weight. Their origin is unknown. Three published examples were of 15, 25 and 40 cm in diameter. Ceramic finds date the shipwreck to the late 5th-early 4th century B.C.[439]. Recently P. Pomey and L. Long have dated the wreck to 400-380 B.C. and have compared the diversity of its cargo with that of the Porticello wreck. They maintain that the ship which sank at Plane was bound for Massalia and carried, to judge by the amphoras, products from Magna Graecia and Punic Sicily[440].

The fact that all cases of finds of ingots in shipwrecks involved mixed cargoes is worth comment. This was probably not only typical of trade in the Classical period but may have been determined by geographical factors. In any case R.J. Hopper thinks that ships carried small amounts of different goods which were owned by various individuals and were destined for various ports. In fact, the very nature of the Aegean Sea must have influenced the appearance of such mixed cargoes and probably resulted in a need for small vessels only. It is less probable that this was the case for trade with the main ports of Asia Minor, the Black Sea and the West. Although seafaring was to a considerable extent, if not completely, coastal in nature, such mixed cargoes were, with perhaps the exception of wood and grain, also the rule[441].

The cargo of the ship which sank near El-Sec in the bay of Palma de Mallorca contained about 500 amphoras from various centres, including 30% of Samian ware, ca. 15% of Sicilian manufacture, and 11% of Corinthian origin. The large number of so-called "amphoras of Pantikapaion" is striking; they compose 8% of the cargo. According to recent studies, they may be of mid-4th century B.C. Chersonessian origin[442]. Besides amphoras the ship's

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438 W. Ameling, 1993, 48

439 *Objets métalliques sur les épaves antiques*, 1984, 8; *Gallia Informations*, 1988, 18-19; A.J. Parker, 1992, N 820 (Plane B).

440 P. Pomey, L. Long, 1992, 195-196.

441 R.J. Hopper, 1979, 48; M.Yu. Treister, 1992, 32-33.

442 S.Yu. Monakhov, 1989, 42-50.

cargo consisted of Attic black-glazed and red-figured ware, millstones and bronze vessels. Among the bronze ware from the shipwreck are fragments of three situlae and lebes, details of a volute krater (which could have been manufactured in one of the Apulian centres, perhaps in Tarentum in the early 4th century B.C.[443]), the handle of a bronze oinochoai with an attachment in the shape of a silene mask (probably of South-Italic or Sicilian production of the early 4th century B.C.[444], and a fragment of a bronze candelabrum contemporary with the finds from the necropolis of Spina in Etruria[445]. There are graffiti on 41 of the vessels from El-Sec. 26 of them are in Greek, 15 in Punic. While some of the Greek graffiti are cargo measures, all the Punic inscriptions are personal names. It has for this reason been suggested that the vessel was most probably owned by traders from Carthage[446]. The authors of the publication reconstructed a probable route for the ship, which in their opinion sank in the second quarter of the 4th century B.C., and suggest that ship had been sailing—gradually taking on goods—from east to the west: from Samos, via Athens, Sicily and Carthage towards Spain[447]. Geochemical analysis of the millstones from the El Sec wreck confirms that the starting point of the ship lay off the west Anatolian coast and suggests an additional port of call in western Sicily off Pantelleria while a further commodity was probably taken on board at Carthage[448]. In the shipwreck were found three round copper ingots 28 cm in diameter and 5 cm thick, weighing 11.5 kg. As the authors mentioned—citing as a parallel the find of lead ingots at Porticello—both ships had been sailing from the Eastern to the Western Mediterranean. This fact is possibly explained by some need to supply Greek colonies from Greece itself, however this idea does not fit with the hypothesis that the vessel was probably owned by Carthaginians[449].

In December 1986 a round table was held at the University of Bordeaux-III about the problem of Greco-Iberian contacts in the

[443] A. Arribas et al., 1987, 539-541, 550-551, figs. 3-4.
[444] A. Arribas et al., 1987, 542-543, 552, fig. 5, 1-2.
[445] A. Arribas et al., 1987, 543-544, 553, fig. 6, 1. It is not a single case of find of Etruscan bronze ware in wrecks. Cf. the find of Etruscan bronze tripod of ca. 470 B.C. in a wreck at the Languedoc coast of Herault; see D. Fonquette, 1986.
[446] A. Arribas et al., 1987, 651-656.
[447] A. Arribas et al., 1987, 651-656.
[448] O. Williams-Thorpe, R.S. Thorpe, 1990.
[449] A. Arribas et al., 1987, 595-599.

4th century B.C., and its main section was dedicated to the find from El-Sec[450]. Among bronze vessels originating from the shipwreck, B. Shefton distinguishes articles of mass production and articles of high artistic quality: a situla, a krater, a candelabrum, which may be considered as introductory gifts similar to pieces from the 8th-7th century B.C. from the south of Spain. The bronzes discussed were, according to Shefton, intended for an Iberian ruler, who had either given permission to sell the ship's cargo, or had even played the role of trade intermediary. J.-P. Morel, referring to the character of the cargo, mentions some parallels from excavations at Carthage. However he does not accept without qualification that the ship was Punic. M. Bats thinks that the Punic graffiti do not necessarily indicate the Carthaginian ownership of the vessel; they may only point to the presence of Carthaginians among the crew. P. Ruillard is also against describing the crew as Punic, preferring the designation "Mediterranean". J.-P. Morel however thinks that we do not know enough about the mechanisms of sea trade to gove any ethnic attribution to the crew. The participants in the discussion do in general agree about the date of the shipwreck: the second quarter of the 4th century B.C.—from 375 B.C. (D. Cerdá) to 350 B.C. or the beginning of the third quarter of the century (B. Shefton, F. Villard, M. Bats). In discussion of the presumed route of the ship, J.-P. Morel expressed doubts that the starting point was Samos—the predominance of Samian amphoras is not enough to prove this[451]. I also think that the considerable number of Chersonessian amphoras gives the grounds for a correction of the supposed route of the ship. It is difficult to imagine given the rarity of fragments of such vessels in Athens and Corinth, which D. Cerdá mentions as an argument[452], that the Chersonessian amphoras had only been transferred to the ship in Athens[453], The contents of the cargo tend to support the hypothesis that such distinctive goods were bought in course of a coastal voyage at their places of manufacture. The view that the vessel which sank near Mallorca had been in the Black Sea is indirectly proved by the find of a Sinopian amphora in the shipwreck[454].

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450 Grecs et Ibères, 1989, 15-146.
451 Grecs et Ibères, 1989, 138-146.
452 A. Arribas et al., 1987, 462-463.
453 A. Arribas et al., 1987, 654.
454 M.Yu. Treister, 1992, 33-34; 1993, 384-385.

The "Athenian Constitution" of Pseudo-Xenophon mentions iron and copper, or bronze as among the most significant articles of import, which were supplied as a result of Athenian supremacy at sea[455]. Iron ore was not mined in antiquity in Attica. As for copper, it was usually brought from Cyprus, although some was mined at Laurion. At any rate, it is known that the copper for the columns of fittings of the Stoa of Philo were said to have been mined in Marion (Cyprus) (fig. 7)[456]. On this view histograms showing the chronological distribution of Attic black-glazed ware in Marion open tempting perspectives. The earliest pieces are dated to ca. 480 B.C.; the highest levels of imports are dated to the 450s B.C. and to 420-410 B.C. and are explained by D.W.J. Gill by a demand for copper at Athens as a result of a need for arms and armour in the period of the Peloponnesian War (fig. 36)[457]. It is thought that the main flow of Athenian ceramic imports entered Cyprus via Marion[458]. Among the numerous Cypriot gravestones found at Athens is the stele of Pnitodames, the son of Stasagoras from Marion[459]. However it is not clear whether one can explain the import of black-glazed ware in terms of the need to buy copper nor is it possible to be sure that copper was exported from Marion in the 5th century B.C., when the only epigraphical evidence is dated to the mid-4th century. Approximately between 470/60-450 B.C. Marion was ruled by the dynast Sasmas, son of Doxandros, a Phoenician, or at least someone with a Phoenician name[460]. A.-M. Colombier explains reductions in imports of Attic pottery to Marion in the second quarter of the 5th century B.C. by political events and the rule of the Phoenician dynast[461]. However, according the histogram showing changes in Attic ceramic imports published by D.W.J. Gill the fall in imports is to be dated to the third, not to the second, quarter of the 5th century[462].

If we bear in mind Herodotus's statement (III. 115) that tin was brought to Athens from far away and remember that Iberian tin

[455] R.J. Hopper, 1979, 96.
[456] G. Varoufakis, 1975.
[457] D.W.J. Gill, 1988, 179-180, fig. 2.
[458] I. Nicolaou, 1986, 426; J. Pouilloux, 1989, 151.
[459] IG, II$^2$, 9284; I. Nicolaou, 1986, 427.
[460] O. Masson, M. Sznycer, 1972, 79-81; V. Tatton-Brown, 1985, 72; A. Destrooper- Georgiades, 1987, 347.
[461] A.-M. Colombier, 1987, 248.
[462] D.W.J. Gill, 1988, fig. 2; M.Yu. Treister, 1992, 35.

had been exploited since the Hellenistic period[463], we might think that it was carried to Athens from Gallia and Britannia, perhaps by the traders from Carthage (Strabo. III. 5. 11), who monopolized the trade in tin[464]. In any case we would probably accept the view expressed by M.I. Finley[465] that Athens could have never survived as a great state or even as a major independent polis without regular imports of significant quantities of grain, metals and materials for constructing ships, which Athens could only have guaranteed due to its sea power. However M.I. Finley himself, stressing the extremely low level of demand especially in small towns, thought that modern scholars were mistaken in exaggerating the grand scale of ancient exports; in his opinion, exports were economically significant only in the cases of primary food supplies (grain, wine, and olives), slaves and luxury objects[466].

The testimony of Xenophon stresses the profitability of carrying silver: "from Athens merchants may take away in exchange a great many different things which people need, or if they do not wish to take any goods as exchange-cargo, they may do good business in taking silver; for wherever they sell this they always receive a higher price than they gave"(Poroi 3.1-2). J. Boardman has recently stated that silver was not an ordinary trade commodity[467]. This view has been attacked by D.W. J. Gill who suggests that silver usually formed part of mixed cargoes, leaving room for other commodities such as wine or oil[468]. That silver was a regular article of Mediterranean trade is suggested by the Naucratis stela of Nektanebos II (360-343 B.C.) which required a "tithe of the gold and silver...which comes from the Greek Sea...and which are produced in Pimemroye, called Naucratis"[469]. However Gill's calculations have shown that very little silver or gold would need to have been carried by sea by contrast to pottery, for example. He also suggests that a certain volume of precious metals were distributed overland[470].

How was trade in metals conducted? R.J. Hopper states that

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463 F. Villard, 1960, 155.
464 S. Isager, M.H. Hansen, 1975, 30-31.
465 M.I. Finley, 1983a, 6; see also: A. Bresson, 1989.
466 M.I. Finley, 1983c, 190.
467 J. Boardman, 1988a, 28.
468 D.W.J. Gill, 1991, 38 ff.
469 B. Gunn, 1943; D.W. J. Gill, 1991, 39.
470 D.W.J. Gill, 1991, 39-40.

there are no evidence for the existence of intermediaries between mine owners at Laurion and mints or exporters of silver[471]. One would think following Ch.G. Starr that permanent sea trading lanes were more a matter of accident in the Classical era, although by comparison to the Archaic period the number of "tramp" carriers was higher[472]. Greek trade terminology was always imprecise and one cannot be sure that there was a clear distinction between local and long-distance traders. Nor is it obvious whether there was a distinction between owners of ships and traders, i.e. the owners of cargoes, although this may have existed in the Archaic period and later on[473].

One can not exclude the possibility that ore was transported by sea in the Classical period, moreover there are examples of wrecks with lead and iron ore, dated to the later period (see below on p. 350). Analysis of bronze objects from Roccagloriosa, a Lucanian site to the south of Naples, which was occupied during the 5th-early 3rd centuries B.C., permits us to decide whether bronze objects were produced there: 1) by remelting scrap bronze originally produced elsewhere; 2) from imported copper ingots and tin metal ingots; or 3) from imported copper ingots and cassiterite. Although there is no conclusive evidence for trade in cassiterite at this time, the economics of shipping ore rather than metal are quite favourable compared to other ores, as cassiterite contains nearly 80% tin by weight. Laboratory simulations of the three bronze-making techniques have shown that the slag excavated at Roccagloriosa could be replicated only by the first two techniques[474]. So, in this case there are grounds for rejecting the view that tin was carried in the form of ore.

### *3.3.3. The Distribution of Metal Objects*

#### *3.3.3.1. Trade*

Numerous finds of Classical Greek bronze and silver ware originate from the periphery of the Greek world, and have been found, for example in rich Celtic, Scythian or Colchian burials[475].

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471 R.J. Hopper, 1979, 60.
472 Ch.G. Starr, 1977, 74.
473 Ch.G. Starr, 1977, 74.
474 M.L. Wayman et al., 1988; M.L. Wayman, 1993, 308-317.
475 See, e.g. about finds in Colchis: O. Lordkipanidze, 1991, 130-131; G.R.

Analyses of shipwrecks in which metal ingots and bronze objects have been found allow us to assume with a high degree of certainty that bronze articles manufactured in Magna Graecia could have found their way to the North Pontic area (finds in Nymphaion, Mirmekion, and the Fourth Seven Brothers tumulus) by the mediation not only of Greek, but also of Carthaginian traders which for a long time played a key role in sea-borne trade in Mediterranean basin[476]. When they had the chance they even called at the ports of Pontus; that is shown by a 3rd century B.C. inscription from Histria in which a Carthaginian grain trader is mentioned[477]. Similarly the products of the North Pontic area could have found their way to Iberia, while the Greek cities of the Pontic coast may have obtained among other articles the metal from Gaul and Iberia needed for local metalworking and bronze vessels from Sicily and Magna Graecia. Thus the system of coastal trade with mixed cargoes was probably more widely spread as R.J. Hopper thought[478]. It would be hard to maintain the division of labour between workshops of various centres and the existence of stable trade links between manufacturers and their customers that follows from V.P. Vasilev's theory that there was a division of labour between workshops.

Was the situation then different with the distribution of articles made of precious metals? For instance, D.W.J. Gill following A.W. Johnston's observations suggests that at least one graffito on an item of silver plate indicates that there was likely to have been an organised method of distribution[479]. This is a graffito, dated to ca. 425 B.C., on a silver mug found in a grave at Stara Zagora, Bulgaria. However, A.Johnston maintained that the significance of such a "ceramic" commercial graffito under a metal vase is difficult to gauge because of its uniqueness. It seems that on one occasion at least silver and clay pots left the Piraeus, or even Kerameikos, in a single consignment. The silver version of the clay mug may have been made specially for the North Aegean market[480]. Therefore, the conclusions reached by Johnston do justify

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Tsetkhladze, 1992, 90; about finds in North Caucasus: I.V. Ksenofontova, 1992; cf. B. Shefton, 1991, 310-311; about finds in Bug and Dnieper basins: N.A. Onajko, 1970.

[476] In spite of its importance, the role of the Carthaginians in the Mediterranean trade should not be overrated. See: P. Rouillard, 1991, 228-233.

[477] M. Pippidi, 1983, N 20.

[478] M.Yu. Treister, 1992, 36; 1993, 383-386.

[479] A.W. Johnston, 1978, 79-80; D.W.J. Gill, 1991, 38.

[480] A.W. Johnston, 1978, 79-80.

the assertion that there was an organised method for distributing silver vessels, indeed they stress the uniqueness of the find.

An ideal model for the distribution of finished articles in the Classical period is given by Locrian mirrors, most finds of which originate from the necropolis of the city or from adjacent sites. This gives good reasons to assume that this sort of production was geared mainly to the local market[481].

### *3.3.3.2. The Distribution of War Booty. Dedications at the Sanctuaries*

The practice of dedicating the arms and armour captured in battles was a further development of the Classical era. In 352 B.C., when Demosthenes delivered a speech against Timokrates (XXIV.120), there was a law in Athens establishing that one tenth of war booty belonged to Athena and a further two percent to other gods[482]. Captured weapons were distributed among the victorious states and their allies; others were dedicated at various state sanctuaries and some at the Pan-Hellenic sanctuaries[483]. The scale of such dedications may be imagined if one uses the data mentioned by Thucydides (III. 113-114). After victory won in winter of 426/5 B.C. in the campaign in Amphilochia under the command of Demosthenes more than one thousand sets of hoplite armour were divided in the following way: one third to the Athenians, 300 to Demosthenes as general, while the rest was distributed among the cities of Acarnania. Demosthenes in his turn distributed 150 set of panoply to the Attic sanctuaries[484]. In the battle near Krimisos in 340 B.C. the winners took one thousand cuirasses and at least ten thousand shields. Some of these were later dedicated at Syracuse, others were sent home by Timoleon to Corinth with instructions for their dedication. Two hundred war-chariots were taken as well as the baggage train with wagons and draught animals (Diod. XVI. 80.6; Plut.Timoleon 29)[485].

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481 B. D'Agostino, 1973, 227; F. Cameron, 1979, 51-53.

482 W.K. Pritchett, 1979, 241.

483 See: W. Gauer, 1968, 21-44; R. Lonis, 1979, 158-160, Tabl. I; S. Morris, 1992, 289 ff. See also a chronological arrangement of the testimonia on Persian weapons and furniture in Athens comprising literary sources and the Parthenon inventories: S. Morris, 1992, 267-268.

484 W.K. Pritchett, 1979, 286-287, 292.

485 W.K. Pritchett, 1991, 159.

However archaeological evidence does not seem to correlate well with literary testimonia. Of the votive inscriptions on greaves dedicated mainly at Olympia, the majority can be dated to the Late Archaic and Early Classical periods and what is perhaps the latest piece is identified by a dedication of the Sicyonians after the battle of Halieis in 459 or 458 B.C.[486].

In the Classical period, victories at sea could be commemorated by appropriate naval dedications. Naval trophies that were dedicated might include the detached beak or ram of a captured galley, the whole prow of a ship, the figurehead or name device of a ship, or indeed a whole ship. An example of the last type of dedication is recorded by Thucydides (II.84), who mentions that the Athenians dedicated a ship to Poseidon on the shore near Rhion, not far from the site of Phormion's victory in the gulf of Corinth during the Peloponnesian War[487].

Votive dedications in the temples may be divided into public and private[488]. They were common not only in the democratic city-states but also in states under oligarchic rule, for instance, in Magna Graecia. As R.Lonis has mentioned, public or civic dedications were most typical in the first half of the 5th century B.C. In the late 5th-4th centuries generals obtained ever more private gain as a result of victory in war. If victorious, a general could expect to receive a large share of the booty and even outright gifts from allies. After Plataea Pausanius was awarded perhaps ten times the amount distributed to other participants, and Spartan kings customarily claimed a third of all booty. Gifts to victorious generals by their men and allies ranged from gold crowns and panoplies to the property of enemy commanders, but gifts to generals could also lead to corruption or charges of treason and bribery[489]. The 4th century B.C. saw the development of a tendency for the personal enrichment of warriors, primarily of mercenaries (the earliest account of the distribution of war booty among soldiers dated from 411 B.C. when Alkibiades plundered Meropis (Kos) (Diod. XIII.42.3)[490]. Reporting on the battle of Krimisos Diodorus (XVI.81) mentions: "The battle yielded a great store of

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486 A. Griffin, 1982, 62; E. Kunze, 1991, 128, N 9.
487 W.K. Pritchett, 1979, 279ff., E. Rice, 1993, 242-243.
488 R. Lonis, 1979, 287.
489 R. Lonis, 1979, 285; E.L. Wheeler, 1991, 142.
490 See: L.P. Marinovich, 1975, 158-164; W.K. Pritchett, 1991, 420 ff.; E.L. Wheeler, 1991, 142-143; P. Millett, 1993, 190-194.

wealth also, because the Carthaginians had with them an abundance of silver and gold drinking vessels; these, as well as the rest of the personal property which was very numerous because of the wealth of the Carthaginians, Timoleon allowed the soldiers to keep as rewards for their gallantry" (transl. by C.B. Welles). One might suggest that part of the spoils of war, probably including the arms and armour, as well as the precious vessels, may have just been divided out on the spot. Clearly, merchants must have accompanied the armies. This can be illustrated by an example of the booty captured by Agesilaes in his expedition in Acarnania in 390/89 B.C.: on the next day after the sack the booty was sold off (Xen. Hell. IV.6.6.), although in this case the booty consisted of live human beings[491].

One might think that in the Classical period the practice of dedicating the victors' weapons in temples was more wide-spread than in earlier periods. That is primarily true of dedications by commanders: especially notable in this respect was Alexander the Great, who dedicated his arms at Arcadian Gortyn and at Troy[492].

The first known sculptures in bronze to reflect some celebrated historical event were the statues of the Tyrannicides cast by Antenor after the fall of the tyranny in Athens in 510 B.C. and installed on the Athenian Agora. It is significant that after the capture and destruction of Athens the statues were taken by Xerxes to Persia and brought back from Susa to Athens by Alexander the Great or by one of the diadoches between 330 and 281 B.C. (Plin. N.H. XXXIV. 70; Paus. I. 8. 5)[493].

The completion of a statue of Apollo Philesios for the Milesian Didymeion, a piece with a significance on a national political level, is associated with the name of Kanachos[494]. The sculpture was conveyed by Xerxes to Ekbatana (Paus. II. 10. 5; IX. 10. 2; Plin. N.H. XXXVI. 41) and brought back by Seleucus I, however it is possible that it had already been taken to Persia during the rule of Darius after the capture of Miletus in 494 B.C.[495]

Describing the capture of Acragas in 406 B.C. Diodorus (XIII.90.3-4) mentions various objects of art including an extra-

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[491] W.K. Pritchett, 1991, 412-413.

[492] W.K. Pritchett, 1979, 271.

[493] See, e.g.: J. Boardman, 1985, 24; P. Gauthier, 1985, 92-93; C.C. Mattusch, 1988, 88, 119-120; S. Morris, 1992, 298 ff.

[494] K. Tuchelt, 1986.

[495] D. Kreikenbom, 1990, 37.

ordinary number of sculptures of every description, worked with great skill. The most valuable pieces were sent by Hamilkar to Carthage; the rest he sold as booty[496].

The Greeks themselves did usually not seize statues as war trophies. However if one accepts the theory of R.R. Holloway that fragments of a statue found near Porticello were from a war trophy taken by the Syracusans after the conquest of Rhegium by Dionysius I in 387 B.C., the sculpture concerned was regarded as scrap metal by the victors[497].

The political significance of state dedications in sanctuaries became more greater after the victory over Persia. The *Symmachia* offered colossal statues in the three sanctuaries of Olympia, Delphi and Delos, representing Apollo with a golden tripod and a snake column (Hdt. IX.81; Paus. X. 13.9)[498]. This tradition was continued later in the 5th century, when an increasing number of members of the *Symmachia* made offerings, but also in the period of the Peloponnesian War, after whose end the economic predicament of the Greek states did not allow this practice to continued for about 30 years[499]. In course of the 4th century B.C. the success of the polis was more often associated with a particular personality. This development influenced the state *Anatheme*, so that the polis was no longer personified only by sculptures of deities or heroes but more and more frequently by the image of a particular citizen. Among the dedicators of bronze statues on the Athenian Acropolis in the 4th century B.C. were individuals and not only from elite families. In the inventories of the Parthenon and Erechtheion, the 73 dedicants named range from citizens to metics, wives, daughters, and possibly courtesans[500]. With the establishment of the Macedonian hegemony over Greece new forms of political symbolism began to take shape with the images of the ruler and members of his family. One example of this is the construction after the victory at Chaironeia in 338 B.C. of the monumental Philippeion at Olympia with its sculptures in gold and ivory[501].

As in the Archaic period, the practice continued of dedicating votives made in the workshops of other Greek centres. A good

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496 W.K. Pritchett, 1991, 194.

497 R.R. Holloway, 1988, 65.

498 B. Hintzen-Bohlen, 1992, 18-19.

499 B. Hintzen-Bohlen, 1992, 20-22.

500 P. Gauthier, 1985, 94 ff.; D. Harris, 1992, 645.

501 B. Hintzen-Bohlen, 1992, 23-32.

example of this is the find of a bronze statuette of Apollo dated to ca. 460-450 B.C. of Peloponnesian, and most probably Argive, workmanship at Lusoi in Arcadia with a dedication to Artemis[502].

### *3.3.3.3. "Technological Redistribution"*

A typical feature of many hoards with coins of the 5th-4th century B.C. is the presence of parts of coins, metal ingots, complete and fragmentary pieces of jewelry, which allow us to consider them as the hoards of jewellers. Practically all of them were found in the territory of the former Achaemenid Empire: in Syria, Egypt, Western Persia and Asia Minor. In early hoards there is a predominance of coins minted in the Thraco-Macedonian region, later on these are gradually replaced by Attic and Phoenician coins. Thus, in this period Greek silver coinage was being converted into ornaments of Achaemenid types[503].

An interesting aspect of the recycling of silver is seen in hoards of Greek silver coins, primarily Attic coins of the 5th-4th century B.C., found in Egypt, where there were no struck coins at the time. In some cases the hoards also contain silver ingots. The metal was most probably acquired as a consequence of the grain trade with Greece and was in part transformed into articles of jewelry, and in part used to pay Greek mercenaries[504]. When after 413 B.C. Attic tetradrachms ceased to reach the East, local imitations were produced in Bactria, Egypt and, probably, in North Syria, Mesopotamia and Asia Minor as well[505].

Votive offerings in temples, mainly of arms and armour, could provide an immense source of raw materials, given the possibilities for re-casting metals. A.H. Jackson maintains that because they mattered so much to the pride and prestige of cities and to their hopes of victories to come, displays might remain on show for centuries, like the Spartan shields from Pylos and those Thebes won from Leuctra seen by Pausanius 500 years later (Paus. I.15.4; IX.16.5). Only fire, earthquake, rebuilding, the sheer congestion of votives, or finally intense political or diplomatic need could dislodge such valuable prizes[506]. At any rate, the practice of

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502 *The George Ortiz Collection*, 1993, N 142; A.E. Raubitschek, 1992, 171.

503 See: C.M. Kraay, P.R.S. Moorey, 1968, 228-231.

504 D. Schlumberger, 1953; C. Roebuck, 1969, 218; C.M. Kraay, 1976, 72-73; J. Elayi, 1988, 34; Y. Garlan, 1989, 62-65.

505 C.M. Kraay, 1976, 73-74; M. Nicolet-Pierre, 1986.

506 A.H. Jackson, 1991, 243-244.

technological redistribution already known earlier continued on an even greater scale in the Classical period.

For instance, golden shields were cast by the Athenians from trophies taken in the battle of Plataea. A golden shield devoted to the Peloponnesian League in Olympia was cast from booty taken by the Athenians and their allies in battle near Tanagra in ca. 458 B.C. (Paus. V. 10. 4). Nor did the metal fittings of ships and equipment only have to be dedicated; they could be—and often were—reused by their captors[507].

As I have stated above, the practice became rarer in the 4th century B.C. Of dedications of the war booty and articles recast from spoils of war at Delphi, dating to 480-300 B.C., three have an uncertain date, sixteen are dated to the 5th century and only two (371 and 369 B.C.) to the 4th century [508]. R.Lonis cites 26 examples of dedications of statues of deities by victors in various Pan-Hellenic sanctuaries. Most of them are dated to the first half of the 5th century B.C., while only three are from the first half or the middle of the 4th century[509]. Another type of dedication is that of the statues of victors, which were generally less popular in the Classical era and had basically different dynamics: five of twelve sculptures were installed in the first half of the 5th century B.C., four (including three figures of Lysander) in the concluding stage of the Peloponnesian War and three more in the 370s B.C.[510]. Finally, metal captured in the form of arms and armour could be used for dedications of various objects: tripods, figures of horses and bulls etc. in the sanctuaries. This practice is known in the 5th century, where eleven of fifteen cases are dated to between 490 and 470 B.C.[511].

At the same time and in contrast to the previous period there was a reduction in the numbers of dedications by Eastern rulers at Greek sanctuaries. This is understandable given the victory of the Greeks in the Greco-Persian Wars and the further expulsion of the Persians from Asia Minor and the Aegean Islands. The example known from Plutarch (Lysander 18.2)—he mentions a trireme in the treasury of the Acanthians in Delphi, two cubits long and

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[507] E. Rice, 1993, 242-243.

[508] W.K. Pritchett, 1971, 99; B. Hintzen-Bohlen, 1992, 18-19. See, for instance, about the dedications of gold tripods by Gelon and Hieron after the battle of Himera: R. Krumeich, 1991.

[509] R. Lonis, 1979, 161-163, Tabl. II.

[510] R. Lonis, 1979, 163-165, Tabl. III.

[511] R. Lonis, 1979, 169-171, Tabl.V.

made of gold and ivory—is dated to the final period of the Peloponnesian War, when Cyrus sent a gift to Lysander after his victory over the Athenians near Egospotames.

Although W.K. Pritchett has shown that there was a difference in attitudes towards arms and armour captured in battle, i.e. "land" weapons, and ships and ship fittings, i.e. "sea" weapons, it is illustrative that in Athens captured ships remained in service; that is proved by inscriptions by magistrates preserved after 377/6 B.C.[512]. Sometimes ship rams are mentioned among dedications in temples; the practice of devoting complete ships was connected primarily with the desire to use the celebration of victory for political propaganda and was common in the Hellenistic period[513].

An example of "technological redistribution" undertaken by city magistrates is the episode mentioned by Plutarch (Timoleon 24), when in the mid-4th century, probably in ca. 343-341 B.C., the Syracusans decided to remedy the city's financial difficulties by selling statues installed at state expense[514]. This same practice existed in Greek sanctuaries as well, where, for instance, in Delos special commissions were appointed to select unsuitable *ex-votos* for melting down[515]. I have already mentioned above the inventory of the treasurers of Athena dated to the 330s B.C. associated with the activity of Lycurgus with its list of bronze statues to be resmelted[516]. This inscription belongs to a rather rare type of inventory, including items that were about to be melted down or destroyed (*katairecis*). A number of such inscriptions is known from later periods[517].

There could also be political reasons for melting down statues. The practice was common in the Hellenistic and Roman eras but was known earlier. For instance, after the ostracism of 487 B.C. the statue of Hipparchos, the son of Charmides, which had been erected on the Athenian Acropolis, was melted down (Lykurg. Leokrat. 117). M. Donderer considers the practice of melting down sculptures of enemies of the state to match the term "*irreversible Deponierung*"[518], however in contrast to sculptures that were hidden intentionally, the metal of these sculptures could be used for other purposes.

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512 W.K. Pritchett, 1979, 279.
513 W.K. Pritchett, 1979, 283-285.
514 G. Zimmer, 1990, 160.
515 G. Zimmer, 1990, 160.
516 D. Harris, 1991; 1992.
517 D. Harris, 1988; 1992, 637-638.
518 M. Donderer, 1992, 225, 271ff.

### *3.3.3.4. Burial Inventories*

Although the use of bronze vessels in burial rites was practically unknown in the previous period (except in the barbarian necropoleis of Scythia, Thrace, Gaul and in the custom of using bronze hydriai which had been fairly common since the 5th century B.C.), the practice become more usual from the second half of the 4th century B.C. (Macedonia)[519].

I. Morris has recently undertaken a study of the distribution of metal grave goods in Athenian burials dated from 500 to 300 B.C. Different patterns are seen in the distribution of metal grave goods in the burials of adults and children in the course of the 5th century B.C. In the 5th century B.C. the peak in the distribution of metal grave goods lies in the second quarter of the century, averaging ca. 0.965 objects per grave. After 400 B.C. there was a small increase in the average number of metal objects in graves[520]. These data are comparable with those of Archaic burials at Ialysos and Kameiros on Rhodes, dated to ca. 625-575 B.C. (thus, the mean number of metal objects at Ialysos varies from 0.7 (vase burials) to 1.0 (cremations), while cremations at Kameiros yielded 1 object per grave in average[521].

### *3.3.3.5. "Irreversible Depositing"*

As I have already mentioned, the practice of irreversible deposting of bronze sculpture was established somewhere in the Late Archaic period. More Classical bronze sculptures are identified as having been intentionally deposited. However, the date of a deposition is often much later than that of the statue. For instance, the Charioteer from Delphi was covered with the fragments of tiles, dating to the first centuries A.D., the portrait head from the temple of Apollo at Cyrene was found below a Hellenistic mosaic, and its date of deposition is the first half of the 2nd century B.C.[522]. Thus, only the statue from Selinus seems to have been intentionally hidden in a terracotta sarcophagus, although the exact date of the "burial" is unknown[523].

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519 C. Rolley, 1986a, 169.
520 I. Morris, 1992, 139, fig. 31.
521 I. Morris, 1992, 188, table 11.
522 M. Donderer, 1992, 254, N 5, 8.
523 M. Donderer, 1992, 253, N 4.

### *3.4. The Role of Metals in Economic and Political Developments in the Classical Era*

In analyzing the "History" of Herodotus one notes that he three times mentioned the mining of gold and silver as a factor contributing to the prosperity of states (Siphnos, Thasos, Athens). Thus, in the 6th century B.C. the income from the Siphnian mines was divided out between the citizens; for a short period after the find of rich deposits of silver in Laurion every Athenian citizen received 10 drachms annually (Hdt. III. 57.2; VII. 144. 1)[524]. The example of Siphnos proves that the exploitation of precious metals did not necessarily work to the advantage of small powerless states. Even the Thasians who invested income from the mining of tons—the Greek cities able to mine precious metals did not used not all their stocks for coinage or for making tools intended for sale for profit. Stocks of precious metals were considered primarily as a symbol of wealth and power[525]. In the mid-5th century B.C. the treasury of the relatively small temple of Artemis Brauronia housed Athenian silver coins alone to a total of more than 3468 drachms[526]. In the third quarter of the 4th century B.C. more than three tons of silver coins were stored in Delphi[527]. In this context it is worth noting an episode described by Herodotus (V. 36): when in ca. 500 B.C. the Milesians plotted rebelling against Persian domination, Hecataeus, a logographer, suggested using the dedication of Croesus at Branchidai to pay for the building of a fleet, however his proposal was not accepted and the rebellion of the Ionian states was quickly and brutally suppressed by the Persians[528].

Somewhat different was a situation in Athens: democratic rule and a more mixed economy allowed big profits to be made from the ownership of the mines. Besides the income from mines, which flowed into the state treasury (judging by the inscriptions of *poletai*, the state was the owner of the Laurion mines[529]), the farmers of the mines gained possession of silver ingots, which they

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524 P. Garnsey, 1988, 79-80.

525 T. Linders, 1987.

526 D. Peppas-Delsmou, 1988, 332.

527 J. Bousquet, 1988, 161.

528 See about the Ionian revolt: S. Morris, 1992, 274 ff. with references: p. 274, note 7.

529 R.J. Hopper, 1968; J.F. Healy, 1978, 103 ff.; cf. J. Ober, 1989, 30; see also A. French, 1991, 37: "The demand for silver, generated by the state for currency, was insatiable; mining revenue was Athens' greatest financial standby".

could convert into coins or sell as silver bullion to the owners of workshops manufacturing silver vessels, which were in their turn bought by rich citizens or stored in temple treasuries (the earliest known inventory of the temple of Athena is dated to 434 B.C. and includes a description of gold and silver objects which were listed as part of the reserve capital of the state)[530]. Such utensils were also exported and found their way for example into Scythian and Thracian tumuli[531]. Such silver was also converted into items of jewelry.

M. Vickers argues that there was a heavy concentration of wealth at the extreme top of Athenian society and maintains that that wealth was evenly distributed with a graduation from affluent to the needy being very gentle: gold and silver plate figures large in both public and private life at a certain level, however, compared with the splendour of Eastern centres, especially with those of the Persian Empire, or even with the sybaritic luxury of Thurii in the West, the level of consumption in Periclean Athens was restrained[532]. Although Vickers' view is not shared by many other scholars[533], I think he is right in throwing out extreme claims about the poverty of the 5th-4th century society, like D. Strong's, that "for most of the fifth century no plate was manufactured for private domestic use in Greece[534].

According to M.I. Finley[535], the ability of Classical city-states to pay for food products, metals, slaves and other necessary goods was based on four factors: 1) the volume of local agricultural production, i.e. the output of the rural surroundings of the city;

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530 D.M. Lewis, 1986; M. Vickers, 1986; T. Linders, 1987; D.W.J. Gill, M. Vickers, 1990.

531 M. Vickers, 1985.

532 M. Vickers, 1990a. Noteworthy is the fact that silver and gold plate listed in the Parthenon inventories was made according the Achaemenian standards. M. Vickers explains this phenomenon by the fact that Persia's economic power and resources were infinitely greater than those of Athens and the Persian standard was a guarantee of quality. see: M. Vickers, 1990a, 620-622. The practice of use of the Persian standard continued even after the fall of the Persian Empire. M. Vickers has recently proved this, analyzing inventories of the sanctuaries at Delos, Didyms etc. See: M. Vickers, 1991; 1992.

533 See, e.g. I. Morris, 1992, 124 ff. with references. I. Morris came to the conclusion, that there was a tendency among the rich to restrict display beginning all over Greece around 500 B.C., gradually being appropriated in Athens by growing popular power, as part of a symbolic system focused on the state monuments. "Just as I argued that the Athenian aristocracy took over polis symbols in the 420s, so too the people may have taken over elite restraint by the 480s, giving a radical twist to a panhellenic custom (I. Morris, 1992, 148).

534 D. Strong, 1966, 74.

535 M.I. Finley, 1985, 139; see also: G.A. Koshelenko, 1983, 234-237.

2) the amount of metals, particularly silver, or of wine and oil in special demand; 3) the export of trade articles and tourism; 4) income from the ownership of land, rents, taxes, and gifts from clients. Income from crafts was insignificant—Finley thought that the incorrect models adopted by some historians had forced them to search for such income, even if it did not exist.

As S.C. Humphreys stated, the end of the 5th century B.C. in Athens was a period of a sudden urbanization, with a sharp increase in the volume of trade and the level of participation in the money economy and of connection between markets; it was a time of new economic roles and opportunities, new demands for the use of the labour force as well as an era of political and social tension and crisis. The process of social change should be discussed in terms of the structural differentiation of roles, spheres of activity and types of interrelation. The dominant importance of political life was growing, however the integration of political and economic activity began to decay. The view of "*zweck-rational*" economic activity as extra-social proved to be inadequate. The social and economic development of Classical Athens gave birth to a society and economy which combined a series of contradictions: in spite of the growth of investment in trade, the mining of metals, and the establishment of workshops using slave labour, such enterprises—except perhaps for those engaged in mining—were casual and not big. The reason for this slow development, however, was not a lack of capital or credit, but is to be sought in public mentality and existing social institutions. Workshops, details of whose organization are known from narrative sources, were managed by slaves and freemen, and their owners who received a fixed income were not interested in expanding them. Such enterprises had probably been acquired by chance and their mergers were unplanned. For example, there was no link between the two workshops owned by the father of Demosthenes: one produced couches, while the other made knives. Similarly there was no link between the bank and the shield workshop owned by Pasion; it is worth remembering that Pasion, a former slave, had evidently invested considerable energy and his personal fortune in the development of the bank; his son, Apollodoros, who had been granted citizenship together with his father, acquired three estates, preferred the shield workshop to the bank and devoted himself to politics and to the magnificent life-style of an "Athenian gentleman". These were the reasons behind Xenophon's idea that the

state should encourage enterprise in silver mining[536]. V.N. Andreev discussed Apollodoros' attitude to the workshop of Pasion, where income was not invested in increasing output, but to provide a constant and fairly high standard of living; he defined it as a sort of "renteneering" and stressed that wealth for the Greeks was not an end in itself, but there to be spent[537]. The structure of the property of Demosthenes-père is of special interest: of his total capital of 13 talents 4600 drachms, immovable property was represented by a house priced at 3000 drachms; the slaves employed in workshops were valued at 3 talents 5000 drachms, stocks of materials for use in manufacture, domestic utensils and jewelry at 4 talents 1000 drachms, and money in cash and in deposits at 5 talents 1600 drachms. If we consider that 20 slaves in the workshop did not belong to Demosthenes but had been given as guarantee for the repayment of a debt of 4000 drachms, then of a total of ca. 14 talents, money comprised 6 talents. If we count vessels and golden jewelry as money, Demosthenes' property consisted of two equal parts. This analysis allowed V.N. Andreev to conjecture that the proportion of money property would usually grow with the growth of the fortune[538]. "Visible wealth" in Classical Athens was extremely vulnerable, as was proved by contemporaries. As a result a surplus of money emerged in society which was not linked to production, the volume of which was at certain periods several times higher than that of "visible" property. V.N. Andreev estimated the value of all cultivated land in Attica to be about 5000 talents and compares this with the 6000 talents in coins and the 500 talents worth of articles made of precious metals kept in the treasury of Athena on the eve of the Peloponnesian War. He considers that private persons owned even larger sums of money[539]. The concentration of wealth in Greek society, as Andreev thought[540], neither resulted from nor resulted in a concentration of the means of production. Andreev suggests that two reasons led to the ruin of the richest Athenian family, that of Kallias-Hippias, an unusual "mining dynasty", one being that Kallias—in absolute keeping with the spirit of the age—had exhausted the family fortune[541]. Mines and re-

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[536] S.C. Humphreys, 1978, 143, 146, 150, 153, 156; see also: R. Descat, 1989, 246-250.

[537] V.N. Andreev, 1983, 13; cf. J. Ober, 1989, 212-214.

[538] V.N. Andreev, 1981, 27-28.

[539] V.N. Andreev, 1981, 33.

[540] V.N. Andreev, 1986, 73.

[541] V.N. Andreev, 1986, 73.

lated enterprises were probably only one of a number of possible sources of income for rich people, and the idea that such families were "in mining" is pure fantasy[542]. The transformation of workshops into sources of "superprofits" was prevented by moral obligations. The masters of Athenian workshops aspired not to remain at the heads of their enterprises but rather to retire and to earn wealth and honour in some other walk of life. Rich Athenians, however, were quite active in leasing mines, and clearly preferred to own estates or to reorganise enterprises, from which one could expect a constant and stable income, rather than any rapid increase in wealth[543]. The object and cornerstone of ancient "prodigality" is probably best explained by the fact that "wealth" which had been accumulated as money and was not derived from manufacture was seen as being there to be spent. V.N. Andreev attached only a minimal role to economic factors in the disappearance of large Athenian properties: he thought that fluctuations in demand would have mainly affected small craftsmen and illustrated this idea by an episode from Aristophanes' "Peace" (1210, 1212-1213, 1250-1252) which mentions the ruin of armourers and traders in arms and armour after the conclusion of peace[544].

Xenophon argued: "Of all the activities I know, silver mining is the only one in which expansion arouses no envy... If there are more coppersmiths, for example, copperwork becomes cheap and the coppersmiths retire. The same is true in the iron trade... But an increase in the amount of the silver ore... brings more people into this industry (Poroi 4.4-6). Xenophon was only thinking of manufacture for a local market, otherwise his remarks make no sense[545]. Besides income from leases of mines the state probably received part of their output in the form of an annual tax. Finally, the state derived large profits from the large volume of coinage[546]. However, even in Athens a considerable quantity of precious metals, including a disputed amount seized from treasuries as a result of the Greco-Persian wars[547], was accumulated in the treasury of the sanctuary. Judging by Thucydides' description (II. 13. 2-5), the treasuries of Athena in 434 B.C. were composed of

542 V.N. Andreev, 1981, 44.
543 V.N. Andreev, 1983, 8-10.
544 V.N. Andreev, 1986, 90-91.
545 M.I. Finley, 1985, 135; P. Gauthier, 1976, 129; see the commentary to Xenophon's project, that the state should invest money in the mining: the purchase of 1200 slaves to work in the silver mines (Poroi. 4.13-32): P. Gauthier, 1976, 136-167.
546 H. Montgomery, 1984.
547 W.K. Pritchett, 1971, 101-104.

gold and silver in ingots and sacred vessels, together weighing not less than 500 talents, i.e. about 13 tons of precious metals. The Athenians considered these stocks as reserve capital, and used them only in extreme situations. For example, in the course of the Peloponnesian War and with the sharp cutback in silver extraction at Laurion, they minted gold coins in 407/6. To be able to do this, Athens had to melt down the temple treasures, including seven gold statues of Nike with a total weight of ca. 13 talents (the sculptures may have been cast of bronze while only their garments were made of silver and gold sheets; one cannot exclude the possibility that a bronze head found on the Athenian Agora and dated to ca. 420 B.C. belonged to one of these statues[548]). However, later on when the need for gold coins was not so acute, the dies were stored in the treasury of Athena, where they were regularly mentioned in inventories in the following century[549]. That such activities were restricted is proved by the extremely complicated procedure for melting down gold and silver votives, including even coins, from the temple treasuries so as to produce new *ex-votos* which took place under the control of magistrates[550].

The devastation of Attica by the Persians in 480 B.C. and the thirty-year decline of the mining industry (at this time there was a sharp reduction in Athenian coin issues[551]) are, to my mind, reflected in Athenian foreign policy. At the very same time Athens once more revealed its ambition to control the region around the Pangaeus mines in Thrace. In 476-475 B.C. Cimon freed Eion in the Strymon basin from Persian domination and taught the Athenians how to colonize this extremely rich and beautiful area (Plut. Cim. 7). A direct reason for this action was a desire to expel the Persians from Thrace, however this strategic aim did not accord with the wishes of the Athenians, who had earlier made a secret accommodation after Cimon's return. At the same time myths were spread to substantiate the claims of Athens to the region, and names like Strymon and Strymodoros were adopted. B. Isaac explains this by the view that this Eldorado *avant la lettre* was ready to be opened up to Athenian penetration[552].

There is a remarkable episode during the Thasian rebellion of 465 B.C. Judging by a passage from Thucydides (I. 100. 2), Athens had laid claim to Thasos because of the presence of trading ports

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548 See: C.C. Mattusch, 1988, 172-175.
549 C.M. Kraay, 1976, 68-69.
550 T. Linders, 1987, 116-117.
551 C.M. Kraay, 1976, 66-67.
552 B. Isaac, 1986, 21.

on the Thracian coast opposite to the island and because of a mine which was exploited by the Thasians on the mainland (probably at Scaptesyle). R. Meiggs thought that it was precisely the natural resources of the Strymon valley that led to the conflict between Athens and Thasos[553]. Most modern historians agree with Thucydides in his definition of the reasons for the conflict, however they give first place to the strategic interests of Athens—a desire to consolidate in this region and to control the route via Thrace to the Hellespont, and thus to increase its influence in Thrace and Macedonia[554]. However, sometimes discussion considers only the strategic reason for the conflict—the fear of Athens that Thasos would make a treaty with the Persians, who still maintained a garrison at Doriskos in Eastern Thrace[555]. The sea route via the Dardanelles did indeed become of great significance in the late 6th century B.C.[556], although to my mind it would be a mistake to reject absolutely an economic motivation for Athenian claims.

It seems likely that in selecting the sites for the settlement of her citizens in the 5th century B.C. Athens was guided by strategic considerations, especially by the advisability of controlling sources of essential supplies or the routes to those sources. This was no less important a motive for sending out colonists than was the desire to provide the poor with a better livelihood (for instance, it has been suggested that Amphipolis controlled valuable timber and silver resources as well as the land route across the Strymon)[557].

After its capitulation in 463 B.C. Thasos lost its ports and a mine and had to pay an annual duty of 3 talents which rose from 446-445 B.C.[558] or 443 B.C.[559] to 30 talents. This increase may mean that the mine had been returned to Thasos, however this is not the only hypothesis[560]. As was shown above, there are grounds for thinking that the Thasians only recovered the mines in Scaptesyle in 360/59 B.C.[561]. The results of the Thasian campaign were seen as unsatisfactory in Athens. Legal proceedings were

553 R. Meiggs, 1982, 126-127.
554 See, e.g.: W. Schuller, 1974, 27-29, 72-73; M.V. Kondratyuk, 1983, 344; W. Steinbrecher, 1985, 104-115; B. Isaac, 1986, 23-51.
555 A. Powell, 1988, 20-21.
556 See: M. Stahl, 1987, 114, Anm. 13.
557 P. Brunt, 1993, 113-114.
558 D. Tzavellas, 1983, 166.
559 R. Meiggs, 1972, 83-85.
560 H. Matthäus, 1988, 24.
561 B. Isaac, 1986, 48.

opened against Cimon after his return from Thasos in 463 B.C. He was accused of having failed to occupy the western coast of Strymon and the mines of the region[562]. This once more stresses the great strategic and economic importance that Athens attached to the conquest of this part of Thrace. In 450/49 B.C. Cimon conquered Marion in Cyprus (Thuc. I. 112. 1-4; Diod. XII. 3. 1-4; Plut. Cim. 18)[563]. One wonders whether this should be associated to at least a certain extent with the extraction of copper ore there. There is, as was shown above, a noticeable reduction in imports of Attic ceramics to Marion in the third quarter of the 5th century B.C.

In this period Athens also made clear its interest in the mineral resources of Etruria. Attic imports to the north of Italy (Adria and Spina) are explained by M. Zuffa as trade to obtain metals from the region; there was also at this time an important trade route into Northern Europe along which tin from Cassiterides was carried[564]. One should remember that this was in a period in which Syracuse probably controlled the Iberian mines, and tin ingots with Syracusan stamps were transported to as far as the Levantine coast.

The active character of Athenian foreign policy in the 60s and 50s of the 5th century is connected with internal political processes in Athens, which were characterized by a strengthening of the role of the *demos*, the traders, craftsmen and sailors, and a stabilization of Athenian democracy, whose the leaders—Ephialtes and especially Pericles—finally overcame the political influence of the aristocracy and managed to initiate a more energetic and decisive foreign policy towards the whole Athenian hegemonia[565]. Some scholars even consider that in the Classical era the political regime at Athens was generally based on an accord between the sailors who possessed citizens' rights and formed the core of the navy, the mainstay of Athenian power, and the majority of the city population, i.e. the craftsmen and traders. To some extent this development of craft and trade at Athens was supported by political factors, in particular the establishment of the Confederacy of Delos[566]. It is worth noting that at the same time in the mid-460s B.C., if one accepts the new dating of the

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562 B. Isaac, 1986, 31.
563 J. Pouilloux, 1989, 152-153.
564 M. Zuffa, 1975.
565 V.M. Strogetskij, 1987, 49; cf. P. Garnsey, 1988, 117 ff.; E.M. Wood, 1988, 110-111.
566 G.A. Koshelenko, 1983, 238-240.

Peace of Kallias[567], the decision was taken to begin a large programme of building on the Athenian Acropolis[568].

One should also accept a suggestion by E.N. Borza, who has shown rather convincingly on the basis of a study of the ecological situation and natural resources of ancient Macedonia, that the expansion of the Macedonian Kingdom was caused by security considerations, These had underlain the policies of the Macedonian kings from the 6th century B.C. (in particular, the seizure of the mountain passes and roads) towards Western Macedonia and Thessaly. Another factor was the need for natural resources, mainly for precious metals, which had made Eastern Macedonia attractive from the time of Alexander I[569].

The examples of Athenian colonization of the Pangaeus region and her economic claims to Thasos, which led to war, are rare episodes in which state interests in controlling deposits of precious metals and other natural resources led in conjunction with strategic factors to hostilities. From the 470s B.C. Eastern Macedonia became an area which drew the attention not only of Thasos and Athens, but also of the Macedonian Kingdom. One might think that such tendencies, rare in the previous era, became more common in the Early Classical period, although they did not lead to a multiplicity of "trade wars". The existence of the latter is proved, for example, by a speech by the Syracusan tyrant Gelon, dated to 481 B.C., cited by Herodotus (VII. 158. 2). Gelon blamed the ambassadors of the leading Greek states for not rendering assistance in a war against Carthage, which was undertaken in order among other aims to liberate Emporia, control of which would have been very profitable[570]. It is interesting to compare this reference in Herodotus with a find of tin ingots stamped with a head of Arethusa and letters from the Iberian alphabet which are dated to

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[567] J. Walsh, 1981.

[568] J. Walsh, 1986.

[569] E.N. Borza, 1982, 18-19.

[570] See: G. Maddoli, 1982, 245, Anm. 5; L.-M. Hans, 1983, 189, Anm. 152; D.-A. Kukofka, 1992, 59 f. The place where the Emporia situated is unknown: perhaps in Western Sicily or even in Spain (see: W.W. How, J. Wells, 1949, 196-197), or in North Africa (A.M. Snodgrass, 1980, 137; P. Barceló, 1988, 155-156, Anm. 17). See, however D.-A. Kukofka, 1992, 60, Anm. 22 against the localisation of Emporia on the North African coast: "Durchaus damit zu rechnen ist, dass einiges, gerade die günstigen Auswirkungen für die Griechen und die Befreiung der Emporia, in der wir am ehesten eine Schwachung der karthagischen Hegemonie und die Erzwingung einer Handelsfreiheit im Westen Siziliens sehen möchten". See about the localisation in Western Sicily also: L.-M. Günther, 1993, 81.

ca. 476 B.C. (see above for their interpretation by M. Arzty). The same tendency is revealed by Herodotus' story (VI. 132) about Miltiades' expedition against Paros in 489 B.C. (see above). W.K. Pritchett considers that such predatory expeditions were typical of that period[571]. The victory of Gelon may have had even more significance, because the Phoenician colonies in Sicily, or so it is thought, were founded in the interests of guaranteeing supplies of silver. On the other hand, practically all scholars accept that in the course of the 5th and 4th centuries B.C. Carthage conducted a trade blockade of the Western Mediterranean and played a dominant role in long-distance trade[572].

In the course of the 6th and 5th centuries B.C. the representatives of the Carthaginian elite, i.e. Mago and his descendants, pursued a policy of expansion with the purpose of establishing and enlarging a hegemonical network connecting the leading families of Carthage and those of the other western Phoenician colonies[573]. That the Syracusan tyrants intended to establish a limited monopoly in the sale of metals is proved by the episode mentioned by Aristotle in the "Politics" (1259a1) and cited above[574].

It is interesting to compare this with the attitude to precious metals and the model of foreign trade suggested by Plato in his model city Magnesia. As only the state may own precious metals,

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[571] W.K. Pritchett, 1971, 60.

[572] C.R. Whittaker, 1978, 80-81; P. Barceló, 1988, 42-43, 53 ff., 160. P. Barceló (1988, 132) considers that trade transactions of the Carthaginians in spite of the possible Greek concurrence took place peaceful. It is maintained that from the mid-4th century B.C. the interest of the Carthaginians in the Iberian peninsula grew substantially. Referring to the passage from Strabo, who cited Eratosthenes : " ...the Carthaginians...used to drown in the sea any foreigners who sailed past their country to Sardo or to the Pillars " (Strabo. XVII.1.19), P. Barceló (1988, 143) suggests that the Carthaginians prevented sailing of strange ships to the South Iberian coast and the Tin islands, however, stating that there are no prove of that in the existing archaeological data. W. Ameling (1993, esp. 265-274) has recently put under question the state trade politics of Carthage. Even if he is right, neglecting the existence of state trade oriented policy, although stating the existence of numerous private trade enterprises ("Die Existenz eines karthagischen Herrschaftsbereiches verschaffte diesen Händlern Vorteile"; W. Ameling, 1993, 273), I see no reason to argue the role of the Carthaginians as intermediary merchants in the Mediterranean basin: "Die Karthager für Zwischenhändler zu halten, ist methodisch problematisch, solange man sich nicht auf eindeutige Zeugnisse stützen kann; bei der Rohstoffgewinnung mittels Handel in den verschiedenen Emporien lässt sich nur ein bescheidenes Handelsvolumen erzielen" (W. Ameling, 1993, 273). The intermediary role of the Carthaginians is well illustrated also by archaeonautical finds which I discuss here).

[573] L.-M. Günther, 1993; cf. P. Barceló, 1989.

[574] C. Lord, 1984, 248, note 30.

the citizens of Magnesia have to surrender any gold and silver coins, and presumably plate, jewels and ornaments in precious metals, as well as bullion, in return for base currency, which is only valid for internal transactions (Laws 742ab). Hence citizens can take no part in foreign trade: there is to be little trade and this is apparently to remain in the hands of public officials. Plato bans the import of luxuries and the export of goods needed at home (847bc). But he admits that it may be necessary to bring in military supplies for the state, which could only be paid for by exports; these operations he assigns to the generals and *hipparchs* (847d), while the *nomophylakes* are to ensure that no imports reach the market (847b-d). P. Brunt mentions that Plato forgets that he has not endowed Magnesia with mineral ores and that some metals would have had to be imported for civilian use[575].

However, even where limited amounts of metal were used for coinage the state probably never used the treasury of the Athenian League for that purpose, even though by 454 B.C. 5000 talents of silver were kept there. It was used later in connection with the Acropolis building programme[576].

An important step in the Athenian protectionist policy which influenced the mining and distribution of silver was the publishing of a monetary decree prescribing that all members of the Athenian League use Athenian coins and measures of weight and length. Independent mints were prohibited and monetary courts were closed. The Athenian mint was to overstrike those foreign coins which belonged to other states or private persons. The dating of the decree raises difficulties: earlier it was dated to between 425 and 414 B.C., however in recent years the date has been changed to the period before 445 B.C.; the new dating is based on epigraphical and numismatic sources[577].

The Peloponnesian War which had upset the balance of the socio-economic structure of the poleis, gave a strong stimulus to the development of large-scale military enterprises, thus leading to a corresponding development of trade and credit operations. State stocks which long been kept in treasuries were put into circulation. However, the hypertrophied development of some types of industry and wholesale trade was accompanied by the ruin of

575 P. Brunt, 1993a, 262, note 56.
576 C.M. Kraay, 1976, 67.
577 R. Meiggs, 1972, 167-173; E. Will, 1975, 100-101.

small craftsmen and traders, especially those who manufactured and sold articles which were scarce in wartime[578].

The next decrease in silver coinage in Athens occurred in the first decade of the 4th century B.C. The reason for this was, as in the second quarter of the previous century, a decrease in the mining of silver. However, Athens, in contrast to some other states, did not strike small coins in bronze[579]. The import of Iberian silver into Greece may have increased at that time: the largest quantities of Attic ceramics in Iberia are dated to exactly the last quarter of the 5th-first quarter of the 4th century B.C.

The instability of the economy and of trade as the result of the Peloponnesian War and its consequences even for the mining industry through a loss of manpower[580] probably also led to a change in the trade routes, along which metals previously circulated. This led to a practice common in the earlier period: coastal sailing in the Mediterranean basin. Note that of two shipwrecks dated to the Classical epoch, both fall into this period and in both cases one can show that the vessels were moving from east to west and that copper was present in the ships' cargoes both as ingots and as scrap. However, by the middle of the 4th century B.C. Athens had recovered from her economic difficulties: her basic industries, farming and mining, were back in full production and Piraeus was again one of the richest centres of trade in the Mediterranean[581].

The first city to issue copper coinage was Olbia, which already in the 6th century B.C. had cast coins in the shape of arrowheads and dolphins and produced so-called aeses from the early 5th century[582]. For a long time no state followed the Olbian example, until the cities of Sicily and Southern Italy began minting small-denomination coins in bronze in the second half of the 5th century B.C.[583]. In the course of the following century bronze coins became common in practically the whole Greek world; Athens, Corinth, Ephesus, and Rhodes were latecomers in minting

578 E.D. Frolov, 1990, 16.

579 C.M. Kraay, 1976, 74.

580 About the socio-economic crisis of the 4th century B.C. in Greece see, e.g.: H.P. Kohns, 1987; about its social consequences, e.g. J. Ober, 1989, 29-30; A. French, 1991, 32-33; I. Morris, 1992, 149-155 with references.

581 A. French, 1991, 27.

582 P.O. Karyshkovskij, 1988, 27-49.

583 C. Boehringer, 1979, 18-31; *Le origini delle monetazione di bronzo in Sicilia e in Magna Grecia*, 1979.

them[584]. The centres which began minting bronze coins surely did so primarily for economic reasons: the rate of exchange for silver and the alloy used in bronze coins was no less than 1: 100-120[585].

Outside Athens metalworking underwent significant development in the Classical era in Sicily and Southern Italy. This was to a certain extent connected with the policies of the Syracusan tyrants, starting with Gelon, who probably established control over the tin mines of Iberia (?) and over the distribution of tin. It was in Magna Graecia in the second half of the 5th century B.C. that small-denomination coins began to be struck in bronze, which brought considerable benefits to the state. Finally, measures by Dionysius such as the organization of the centralized manufacture of weapons for the army and the general development of artillery, caused an accelerated development of metallurgy and metalworking. To set up such mass production of weapons it was necessary to accumulate significant supplies of both bronze and iron as well as of the precious metals needed mainly for coinage. The same purpose lay behind a tax, the *eisphora*, which was introduced by Dionysius in wartime. He conducted an extremely active monetary policy by issuing coins of various values in gold, silver and bronze with a tendency for large denominations to predominate[586]. A famous sea expedition by Dionysius to Etruria and Corsica served, according to Diodorus (XV.14. 3-4) primarily to obtain the resources necessary for a planned third war with Carthage. However, C. Boehringer suggested[587] that Dionysius was attracted by the silver and copper mined in Etruria; besides Corsica was on the route from Syracuse to Massalia, which played an important role in the tin trade, and tin was necessary for the bronze coins produced on a large scale by Dionysius[588]. This hypothesis has some attraction given the reference in the Pseudo-Aristotelian "Oeconomica" (1349a 32-36) to the fact that when Dionysius did not have enough silver he struck "tin" money and later gave a speech in the peoples' assembly in defence of this. The same story is told by Pollux in his "Onomastikon" (9.79): Dionysius forced the Syracusans to accept "tin" money instead of silver, deriving, thus,

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584 M.J. Price, 1968; C.M. Kraay, 1976, 253; T. Hackens, 1987, 158-159.

585 M.J. Price, 1968, 103; *Le origini delle monetazione di bronzo in Sicilia e in Magna Grecia*, 1979, 363.

586 C. Boehringer, 1979.

587 C. Boehringer, 1979, 25-26.

588 There are other points of view concerning the reasons of Dionysius' sea expedition. See, e.g.: E.D. Frolov, 1979a, 80-81; 145-146.

an enormous profit because of the considerable difference in the prices of these metals[589]. One should note that the peoples' assembly was convened during the rule of Dionysius only at critical moments for the state and this body was competent to discuss and resolve problems of extraordinary gravity[590]. In any case, the use of weapons which were modern for that time was a factor in the successful prosecution of wars which brought Dionysius enormous profits from booty, spoils seized from temple treasuries and silver received for the ransom of captives[591]. A similar situation occurred in the period before Timopheus' expedition against Olynthus, when he convinced traders to accept bronze ingots but promised them to pay the full amount later in silver[592]. It is no mere chance that bronze coins came to be defined as follows: "*monnaie de bronze = monnaie d'urgence, de guerre, de siege*"[593]. However, wars led not only to a transition to bronze coinage but also to the issuing of new denominations, special issues both in silver and gold—various examples are listed by C.M. Kraay[594]. The transition to bronze coinage did not occur painlessly everywhere. For example, in Gortyn in Crete, although at a later period, in ca. 250-220 B.C., a special decree was published regulating the transition to bronze coinage[595].

While in the 5th century B.C. the winners usually dedicated a part of their booty at the Pan-Hellenic sanctuaries,—at Delphi, for instance, this included both part of the captured treasuries and metal for casting bronze statues[596]—in the following century a quite different practice was common[597].

Virtually all the booty from Athenian campaigns was destined

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589 See: B.A. van Groningen, 1933, 127-129; B.A. van Groningen, A. Wartelle, 1968, N 20 a-e; C. Boehringer, 1979, 27-29; T. Hackens, 1979, 326 suiv.

590 E.D. Frolov, 1979á, 102-103.

591 W.K. Pritchett, 1971, 71-72. W.K. Pritchett (1991, 160) maintains that a prime object of plunder in the baggage train or camp must have been money, referring to a victory of Dionysius over the Carthaginian fleet in the harbour of Syracuse in 396 B.C., when Himilkon, the Punic general was allowed to sail away secretly at night giving up to Dionysius three hundred talents (Diod. XIV. 75.1).

592 M.J. Price, 1979, 358; P. Millett, 1993, 191 ff. See about Timopheus also P. Gauthier, 1985, 102-103.

593 T. Hackens, 1979, 336; Y. Garlan, 1989, 59-61.

594 C.M. Kraay, 1984.

595 A.E. Jackson, 1971.

596 W.K. Pritchett, 1971, 98-100; see about the prevailing dedications of the expensive metal votives, for example the mirrors with supports, weighing 1,5-2,5 kg, which were practically unused in the private life, in the 5th century B.C. sanctuaries: H. Salskov Roberts, 1988, 255.

597 P.C. Bol, 1985, 64.

for public rather than private consumption; in theory, this meant for the treasury. Victorious commanders could be granted a share of the plunder only by a vote of the *demos*, and *strategoi* returning from campaigns had to render a formal account of expenditures and gains. To assist (and control) them, they were accompanied on their travels by treasurers. However, the chronic underfunding of campaigns seems to have had a double function. In part it reflected the straitened circumstances of a polis fighting wars without the revenues of empire; commanders were forced to raise their own resources, easing the strain on the treasury. In addition, the lack of funds drove commanders to plundering[598].

The practice of plundering sanctuaries in which enormous stocks of precious metals in ingots, coins and artistic objects were accumulated became ever more common in the 4th century B.C.; this is shown by the story in Diodorus (XVI. 56. 5-7) about the pillage of the Delphic treasury by the Phocians in 347/6 B.C. In order to pay the mercenaries votives were used as raw metal for coins: these included some which had been offered by Croesus: 120 gold bricks each weighing 2 talents, 360 gold bowls, each having a weight of 2 minas, golden statues of a lion and a woman weighing 30 talents together and numerous silver articles. The total value of precious metals turned into coins was 10000 talents in silver equivalent. The seizures by the Phocians were not made from an enemy shrine and did not constitute booty, but they illustrate the accumulation of riches at a major Greek sanctuary[599]. The Phocians stole the golden decorations from the Plataean tripod at Delphi, a monument honouring the victory over the Persians at Plataea[600]. Robberies of temples and of images of the gods were particularly characteristic of tyrants, who needed money to maintain their mercenary armies. The worst offender, as I have already mentioned, was Dionysius the Elder. Sacrilegious plunder became a regular source of money for Dionysius[601].

The fact that in course of the 5th-4th centuries B.C. Greek states were displaying a growing interest in controlling supplies of metal is shown by the inscription mentioned above from the mid-4th century B.C. from Eleusis and by the stele of the so-called Monetary Union between Mytilene and Phocaea which is dated

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598 E.L. Wheeler, 1991, 142, note 104; P. Millett, 1993, 190-194.
599 W.K. Pritchett, 1971, 73; 1991, 167.
600 W. Gauer, 1968, 75-96; B.S. Ridgway, 1977, 374.
601 W.K. Pritchett, 1991, 163-165.

probably to ca. 394 B.C., however it may be a copy of the earlier treaty. This latter document states that a magistrate was nominated annually to control the composition of the alloy used for coins[602].

Finally, the development of toreutic centres was influenced by the needs of the court. For example, Tarentum, a city under oligarchic rule and oriented in its contacts to the monarchies of Epirus and Macedonia, became a trendsetter in the Greek world. We should remember that the growth of metalworking in Sicily and in the south of Italy took place in the absence of a local metallurgical base.

Another example of an increase in the power of the state due to the exploitation of gold mines is to be found in Macedonia under the rule of Philip II. The capture of gold mines following his first campaigns against Damastion, Amphipolis and Crenides between 358 and 356 B.C.,—to which were added Thracian silver deposits in 346 B.C.—allowed him to produce an issue of gold coins needed to maintain his large army and to bribe the Greek states; the reason for this is mentioned by Diodorus (XVI. 8. 7)[603]. At the same time there was a significant increase in the output of silver coins from the royal mints at Pella and Amphipolis[604]. The advance to the north-west in 356 B.C. up to the river Drylon allowed the king of Macedonia to gain control of the copper and iron mines of the Maty valley. After his victory over the Chalcidian League in 348 B.C. Philip acquired the mines of Chalcidike, which were not only rich in deposits of gold and silver (Mt. Stratonike), but of copper and iron as well; in 337 B.C. he took the gold and silver mines of Dardania, and after the annexation of Paeonia into the Macedonian Kingdom seized the deposits of gold, silver, copper and lead in Kratovo[605]. The difference between the economy of the Macedonian kingdom and those of every Greek *poleis* lay in the practically absolute concentration of the wealth of the state in the hands of the king: Philip, and later, Alexander, owned the principal mines of gold, silver, copper, iron and other minerals as well as the forests and other natural re-

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[602] J.F. Healy, 1978, 201-203; F. Bodenstedt, 1981, 29-31.

[603] See: T.R. Martin, 1985, 284-285; A.B. Bosworth, 1988, 8; N.G.L. Hammond, 1989, 159, 180-181. See about the events and chronology of the Sacred War also: J. Buckler, 1989.

[604] H. Montgomery, 1985, 41-42; see about the chronology of Philip's coin issues: T.R. Martin, 1985, 271-279.

[605] N.G.L. Hammond, 1989, 180-182.

sources. Philip established a state body to control mining—the *kataskeuai*: the mines were not leased, but run by civil servants (Diod. XVI. 8. 6). Thus, the state in the person of Philip himself had interests in the security of mining and technical improvements (Arr. An. VII. 9. 2-3)[606]. As M. Austin noted, "successful warfare in the world of the fourth century needed financial resources, as all Greek states found out, and that was something the Macedonians did already possess at home in the shape of their mines"[607].

As N.G.L. Hammond rightly noticed, the financial and economic achievements of Philip, although they were not as impressive as his successes in the field, were no less important: he created a strong stable economic system which allowed Macedonia to remain a leading power for almost two centuries[608]. This was the era in which the local centre of metallurgy and metalworking flourished; its products found their way not only into the tombs of Macedonian nobles but were exported to far countries where they influenced the development of various schools of metalworking (Asia Minor, the Kingdom of Bosporus)[609]. The need to organize an army, a considerable part of which consisted of mercenaries, led to the manufacture of weapons. Metalworking was also promoted by large building programmes and the construction of fleets. Like the Syracusan tyrants, the Macedonian kings certainly derived profits from the money spent on armories, including large stocks of precious metals. One should remember that in 330/29 B.C. Alexander took in Susiana 40000 talents of gold and silver in ingots and 9000 talents in gold coins and in Persepolis 20000 talents[610].

The progressive development of large metalworking enterprises, which mainly used slave labour, occurred in the 4th century B.C., and were as we saw above largely employed in production for the military. This was to a considerable extent associated with the widespread use of mercenary soldiers, which was one of the factors which led to the crisis of the Greek *poleis*[611].

However, it would be wrong to say that there was any competition between silver manufacturers in this period. Some scholars

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606 N.G.L. Hammond, 1989, 162, 178-179.
607 M. Austin, 1993, 218-219.
608 N.G.L. Hammond, 1989, 186-187. See also G. Shipley, 1993, 17.
609 M. Pfrommer, 1983.
610 W.K. Pritchett, 1971, 61.
611 L.P. Marinovich, 1975, 178-214; E.D. Frolov, 1990, 22, 28-29.

think that the extraction of at Laurion was influenced by international events in the mid-4th century B.C. The Thracian mines captured by Philip II dumped large amounts of silver onto the market; this led to a fall in prices; thus it is not surprising that the leaseholders of the Laurion mines belonged to the Anti-Macedonian party at Athens[612]. Analyzing inscriptions bearing leasing contracts, B.S. Strauss came however to the conclusion that only three out of 350 leaseholders known from such leasing treaties supported the Macedonian party; the decade 350-340 B.C. was marked by the highest level of activity at Laurion; Athenian coins were not pushed out of the markets, where they circulated freely (in Asia Minor, the Middle East, and Egypt)[613]. Thus, Philip of Macedon never attempted to undermine the wealth of Laurion either by reducing the prices of silver or by conquering the markets, in which Athenian coins circulated[614], whereas it is erroneous to seek to explain the stand of some officials of the Anti-Macedonian party by their economic interests in silver mines[615]. Moreover, not all centres ceased producing gold and silver coins after they were captured by Philip. Some of them, for instance Abdera and Thasos, probably preserved some sort of privilege to obtain metal from the mines; under the reign of Philip his silver did not supplant local coins to the east of Strymon[616].

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[612] É. Ardaillon, 1897, 159-160; S. Lauffer, 1979,153-170, 283-285.
[613] See: S. Isager, M.H. Hansen, 1975, 42-49.
[614] B.S. Strauss, 1984.
[615] V.N. Andreev, 1981, 44.
[616] See: C.G. Lorber, 1990, 57-78.

CHAPTER FOUR

# THE ROLE OF METALS IN THE HELLENISTIC ERA

## *4.1.1-2. Mining in the Light of Ancient Written Sources and of the Results of Archaeological and Archaeometallurgical Studies*

By the end of the 4th century B.C., to judge by Demetrius of Phalerum cited by Strabo (III. 147), the Laurion mines (fig. 4) were in a state of decay. In 229/8 B.C. Athens was unable to pay the sum of 150 talents needed to effect the withdrawal of Macedonian troops[1]. M. Grant considers that the revival of mining at Laurion should be dated to the 3rd century B.C. and that in 229 B.C. Athens was able redeem the city by paying off its Macedonian garrison[2]. Nevertheless, the minting of New Style tetradrachms started only in the first half of the 2nd century B.C.[3]. Some historians are concerned that old coins were reused for this purpose[4]. As the results of analyses have shown, the metal used for these coins originated from the mines of Laurion. The metallurgical complexes near Pantatetsa and Thorikos and the round or elipsoid constructions used for ore washing (which contrast with the earlier rectangular buildings) are dated to the 3rd-2nd century B.C.[5]. In the 2nd century B.C., to judge from lead isotope analyses, metal from Laurion was being traded in other centres: it was used for coins in Syria and Alexandria[6]. Mining was probably conducted on a limited scale in the second half of the 2nd century B.C.[7]. In the late 2nd century the slaves working in Laurion

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[1] E. Will, 1966, 329.

[2] M. Grant, 1982, 107.

[3] The hypothesis put forward by O. Mørkholm and supported by M. Thompson, that the start of the New Style mintage should be dated to the period after the Roman victory near Kynoskephaloi in 197 B.C., i.e. to 185-180 B.C. is accepted by some scholars, although another adopt the traditional date of ca. 165 B.C. See, e.g.: M.H. Crawford, 1985, 125; M. Price, 1987, 100, note 3; cf. I.Touratsoglou, 1987, 63, note 13. The evidence of hoards suggest a date as late as the 160s B.C.: see: O. Mørkholm, 1991, 170. Most recently the late dates for the start of the mintage were maintained by M.J. Price and H.B. Mattingly. See: C. Habicht, 1991, 2-3, Anm. 4 with references.

[4] A. Giovannini, 1978, 62 ff.; R.J. Hopper, 1979, 188.

[5] H. Kalcyk, 1982, 144; 1982a.

[6] I.L. Barnes et al., 1974, 8.

[7] S.V. Tracy, 1979, 232, note 71.

rebelled, occupied the Acropolis at Sunion and for some time devastated Attica (Poseidonius in Athenaeus VI.272 E-F = FGrH 87 F35). This was supposed to have taken place in ca. 100 B.C. and led to disruption of silver extraction. Strabo (IX.1.23; X.1.9) informs us that in his time, at the end of the 1st century B.C., the mines had been exhausted[8].

In consequence of a find of lead ingots with Latin stamps in the Mahdia shipwreck it has been suggested that Roman concessions at Laurion might have been worked at the very beginning of the 1st century B.C. However, this hypothesis by A. Merlin[9] does not seems to be argued with any strength (see below on p. 354).

At Petres in Western Macedonia considerable amounts of iron slag and other evidence of metallurgical and metalworking activity were found during excavations of a 3rd century B.C. settlement (fig. 37)[10].

At Knossos furnaces of the Hellenistic period were unearthed, where copper and bronze had been smelted. Here were also found pieces of iron slag weighing up to 2.5 kg[11].

The centre for mining and metallurgy in Macedonia which received a stimulus during the reign of Philip II, went into decay in the course of the 3rd century B.C.[12] and reached the peak of its activity during the reigns of Philip V and Perseus in the first decades of the 2nd century B.C.[13]. It is worth remembering the passage in Livy (XXIX. 24.2), referring to 185 B.C., which says that Philip "not only increased the revenues of his kingdom from the farm crops and the harbour duties, but also reopened old mines long disused and began operations on new ones in many places" (transl. by E. Sage). It is thought that successes in mining were due to the prospecting of deposits and to improvements of mining technology[14]. However, defeat in the Third Macedonian War against Rome and the treaty of 167 B.C. led to the closing of the gold and silver mines of Macedonia; the Romans only allowed

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[8] S.V. Tracy, 1979, 232-235; G.R. Bugh, 1988, 198; O. Mørkholm, 1991, 3.
[9] A. Merlin, 1912, 391.
[10] E. Photos et al., 1988.
[11] E. Photos et al., 1985.
[12] D. Tzavellas, 1983, 167-168.
[13] E. Will, 1982, 248-268; O. Mørkholm, 1991, 3.
[14] N.G. L.Hammond, 1989, 362. Under Philip V and Perseus an important innovation also took place in the coinage system. See, e.g. O. Mørkholm, 1991, 164 f.

copper and iron mining if they were paid half the duties received by the king[15].

Lead-silver ores were mined in Anatolia. In slag debris from the Işik Dağ mine in the Ankara province Hellenistic pottery has been found[16]. In slag heaps in Güre on the Biga peninsula in North-Western Anatolia Hellenistic sherds have also been unearthed[17].

Gold and silver were mined on Mt. Ida in the Troad, which supplied the kingdom of Pergamon, as well as in the region near Abydus and Lampsacus, which accounts for the relatively abundant production of Alexandrian gold in these two cities. Other mines were found in the mountainous interior, for instance the silver mines in Pontus and those in the Taurus mountains in Cilicia and Cappadocia[18].

Copper mining was established by the Attalids in the north-west of Asia Minor[19]. For example, in the Troad a fragment was found of a Hellenistic lamp in the mine of Serçeören Köy in the province of Balekisir, south of the Marble Sea coast[20]. Hellenistic pottery has also been recovered from the huge accumulations of slag from the mines on the Biga peninsula[21].

In the Troad (Balekisir province) Hellenistic ceramics have been unearthed from ironmaking slag in Kizil-Tepe and Açarlik-Tepe; C-14 analyses of charcoal from the Altinoluk mine produced a date of the mid-3rd century B.C.[22].

Copper deposits were certainly exploited at Strandzha near the Black Sea coast of Thrace. Pottery from the Rossen slag heaps has been dated to between the 2nd century B.C. and the 4th century A.D. Between the Cape of Atiya and the Rossen mine—1.5 km from the mine—the remains were excavated of a large settlement of the 2nd-1st century B.C., where stone platforms for the dry enrichment of copper ore were found[23].

In Thasos lead-silver ores were mined, this being proved by thermoluminescent analysis of pottery fragments and gold (C-14

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15 E.S. Gruen, 1982; D.C. Samsaris, 1986, 17-18; N.G.L. Hammond, 1989, 378-381; G.A. Koshelenko, 1990, 158-159; see about the topography of copper and iron mines in Macedonia: D.C. Samsaris, 1986, 19-23.

16 T.C. Seeliger et al., 1985, 600-601.

17 E. Pernicka, 1987, 649.

18 O. Mørkholm, 1991, 3.

19 See: M.I. Rostovtzeff, 1941, 657 ff.; J.F. Healy, 1978, 58.

20 G.A. Wagner et al., 1986, 734-735.

21 E. Pernicka, 1987, 666.

22 E. Pernicka et al., 1984, 544, 546, Abb.7; 547, Abb.9 b-c; 598.

23 E.N. Chernykh, 1978, 19-20.

analyses of charcoal gave a date of 390-200 B.C.)[24]. Archaeological materials from the gold mines of ancient Kenyra allow us to determine the period in which the mines were worked fairly precisely to the second half of the 4th – early 3rd century B.C.[25]. At the same time, archaeological data indicates that gold was mined under the Acropolis of Thasos (fig. 6 )[26]. Only the copper mine in Makrirahi has yielded finds which can be dated to a somewhat later period—to the end of the 3rd – early 2nd century B.C.[27].

Copper mining took place in Archani (Phtiotis) where more than 150,000 cubic metres of slag have been found. Metallurgical activity began there no later than the 11th century B.C. and was probably not of any long duration. Finds of pottery and the remains of furnaces belong to the 4th-2nd centuries B.C. It is thought that Archani was a prominent metallurgical centre in the Hellenistic era[28].

Gold deposits in the Upper Nile basin were mined from at least the mid-3rd century B.C., this being testified to by the cartouches of Ptolemy III on the columns of the temple of Men there, by an ostrakon of that period and a document from the Zenon archive dated to 257/56 B.C., where an inspection of the Thebaid mines is mentioned. That the Ptolemaic administration had control of gold production is proved by a document dated to October 28th, 258 B.C.[29]. These mines in Lower Nubia and the Eastern Desert near the Red Sea, described by Agatharchides, were probably conquered by Ptolemy Philadelphus in the course of an Ethiopian campaign, about which practically nothing is known except for a reference by Diodorus (III. 12-17)[30]. Mining for metals was a royal monopoly[31].

The view that Cyprus, due to its richness in metals, forests and agricultural products, played an important role in the economy of the Ptolemaic Kingdom, has been generally accepted. However, the system of administrative control of metal extraction in Cyprus can be reconstructed only on a rather provisional basis because of

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24 A. Hauptmann et al., 1988, 109; G. Weisgerber, G.A. Wagner, 1988, 153.
25 C. Koukouli-Chrysanthaki, 1988, 177.
26 A. Müller, 1979.
27 C. Koukouli-Chrysanthaki, 1988, 178; G. Weisgerber, 1988, 210.
28 A. Papastamataki et al., 1986, 43-44, 54-55.
29 F. Burkhalter, 1979, 70-71.
30 R.J. Forbes, 1950, 148, 158, 160; P.M. Fraser, 1972, 176; O. Mørkholm, 1991, 4.
31 F.W. Walbank, 1981, 111.

the total absence of narrative sources. The most important financial official was an *ekonom*, as was the case with the administration of other possessions of the Ptolemies, and proof of his existence is provided by a letter dated 257 B.C. from the Zenon archive. He exercised control over the mines. An attempt was made to create a state monopoly in staple products on Cyprus and in any case in the reign of Ptolemy IX the post of *epi ton metallon* existed in Cyprus. It has been suggested that strict control of metal extraction was a central feature of royal policy throughout the Hellenistic era[32]. However the results of archaeometallurgical studies compel us to reconsider the role of Cyprus as a major copper "exporter" in the Hellenistic period.

Analyzing metallurgical activity in the region of Polis, P.Raber came to the conclusion that there had been reduction in the number of sites at which copper ore was smelted. The whole production of the Polis region over three centuries (from the Hellenistic to the Early Roman periods) is estimated at several hundred tons. Manufacture, as in the previous period, was concentrated in the vicinity of the mines, and settlements connected with ore processing were near to a new centre, Arsinoe, which was revived in place of Marion after Ptolemy I had destroyed the latter in 285 B.C. (fig. 7, 3). A sharp decline in metallurgical activity in the region is, in Raber's opinion, to be explained by the incorporation of Cyprus into the economic and political system of the Ptolemaic state and the establishment of large centres for extracting and smelting copper ore everywhere on the island. The Hellenistic, and later on, Roman rulers of the island, who were well able to coordinate the exploitation of its resources, concentrated metallurgical operations in regions with good communications. The comparative isolation of the Polis region led to a situation, in which the business of copper mining there was conducted by the local population to satisfy their own needs for metal[33].

However, it is evident that the decay of metallurgy on the island was not at all a local phenomenon. Anyhow, while in the Early Hellenistic period copper continued to be actively extracted, the absence of ceramic finds from the later era (up to Late Roman times) and the results of C-14 analyses of charcoal indicate that there was a break in the production of copper in the Late Helle-

[32] R.S. Bagnall, 1976, 79, 227.
[33] P. Raber, 1987, 305.

nistic times on the island which lasted down to approximately the 3rd century A.D.[34]. This is probably corroborated by a reference by Eratosphenes (3rd century B.C.), who described the gradual spoiling of the forests in the plains of Cyprus (Strabo. VI. 84), stating that this was originally influenced by mining, but later by the demands of shipbuilding and agriculture[35].

During the reign of Seleucids the state had its own sources of essential metals, including gold[36]. In the words of O. Davies, the Seleucid Kingdom was at its peak the first civilised state in the history of Western society to be able to supply its requirements for metals from its own resources[37]. Apart from the mineral wealth of Asia Minor, the first Seleucid kings could draw upon the resources of the Middle East. Riverine gold and silver sources existed in Carmania according to Onesicritus, one of Alexander's followers (Strabo. XV. 2. 14). O. Mørkholm maintained that gold from faraway Siberia and the Altai mountains may have reached the Seleucid empire via its eastern province of Bactria[38]. However, later on there was a fundamental change in this situation with the loss, one by one, of sundry parts of the state following the reign of Seleucus II. Most of the metalbearing regions of Asia Minor fell under the sway of states independent of the Seleucids. The central part of Asia Minor with its rich ore deposits was incorporated into the Pergamene Kingdom, while the regions of the south-eastern littoral of the Black Sea, the Southern Caucasus, Armenia and part of the Taurus fell to the Pontic Kingdom. Finally, the whole of Asia Minor was excluded from the Seleucid state by the terms of the Treaty of Apamea of 188 B.C.[39].

In the West the most important mines for all metals were situated in Spain, although scattered from the Pyrenees in the north to Turditania in the south. Gold may also have come to the Western Mediterranean from the fabulous Gold Coast in Africa via Carthaginian sea trade or by way of caravans crossing the Sahara[40].

The working of the lead-silver deposits of Rio Tinto was revital-

[34] F.L. Koucky, 1982, 128; *Early Metallurgy*, 1982, 138.
[35] R. Meiggs, 1982, 373, 379, 397.
[36] H. Wilsdorf, 1952, 170-171.
[37] O. Davies, 1935, 1.
[38] O. Mørkholm, 1991, 4.
[39] M.I. Rostovtzeff, 1941, 55, 62 ff., 1174 ff.; R.J. Forbes, 1963, 144-145; J.F. Healy, 1978, 47; E. Will, 1982, 221-224; O. Mørkholm, 1991, 4, 123-127.
[40] O. Mørkholm, 1991, 4; see about the Carthaginian trade station in West Africa, e.g.: F. Lopez Pardo, 1992.

ised in the Hellenistic period: it is held that the main part of slag heaps with a depth of ca. 4-5 metres belong to that time[41].

Fragments of ceramics of the "castros" type from the pre-Roman era originate from a tin workshop at San Salvator de Padreiro, and an gold earring dates alluvial stanniferous workings at Monte Neme to the 4th-3rd century B.C. (both sites are in North-Western Spain)[42]. The remains of lead workings dated to the same period have been uncovered at Castillico de Las Penas (Fortuna, Murcia)[43].

Another mining district of importance was situated near Aquileia in the territory of the Noric Taurisci. According to Polybius (XXXIV. 10.10) the opening of a new mine in that area in his own days led to a temporary fall in the price of gold in Italy by one-third, showing the effect of a single lucky strike[44].

### *4.2.1. Metalworkshops in the Light of Archaeological and Archaeometallurgical Studies*

In the area of the Athenian Agora we know of four casting pits and the remains of foundries and smithies which date to between the 4th-3rd and the 1st century B.C.; there are further separate finds which belong to the Hellenistic period and are associated with bronzeworking[45].

In the excavations at Corinth there were no finds of remains of workshops dating to between the 4th century B.C. and the Early Roman period[46].

At Olympia the remains of Hellenistic workshops were also unknown until recently, however one of the casting moulds found at Olympia is dated to the second half of the 3rd century B.C.[47]. Moreover, G. Zimmer defines the object S1, unearthed near the foot of the mound of Zeus in 1937, as the remains of a typical casting pit; finally in 1982 excavations of the workshop of Phidias at Olympia revealed a casting pit of the 3rd-2nd century B.C.[48].

Pits for casting a large bronze sculpture (the Colossus of

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41 B. Rothenberg, 1989, 63.
42 C. Domergue, 1990, 170.
43 P. Rouillard, 1991, 207.
44 O. Mørkholm, 1991, 4.
45 C.C. Mattusch, 1977, 358-368, 375; 1988, 222; G. Zimmer, 1990, 115-117.
46 C.C. Mattusch, 1977a, 382; G. Zimmer, 1990, 82.
47 W.-D. Heilmeyer, 1969, 12-14.
48 G. Zimmer, 1990, 98-100.

Rhodes) and dating to the early 3rd century B.C. have been unearthed on Rhodes[49]. Also on Rhodes, lead articles of local manufacture were found during excavations of a Hellenistic house[50]. One of the rooms of a Late Hellenistic building adjacent to its inner courtyard revealed the remains of a primitive furnace, pieces of ore (lead oxide), shapeless fragments of lead, as well as several objects, including a piece of lead sheeting, a vase handle and small weights. All this proves not only that lead articles were manufactured, but lead itself, i.e. the raw material, was produced from ore[51].

On the island of Amorgos, excavations were conducted in the lower town area of buildings of an industrial character and of furnaces; in a cistern containing Hellenistic materials there was found a terracotta head of a bearded man 1.25 m high. It is thought that this head was used as a model for making a bronze statue[52].

During excavations of the anaktoron at Demetrias traces of bronzeworking were unearthed, represented by slag and numerous fragments of clay casting moulds. Also excavated were early 2nd-century B.C. casting pits[53]. It is held that two pairs of mould-bases found one on top of the other were used for the serial casting of a statue's arms and legs[54].

During the excavations of the so-called "*katagogion*" in the market area of Kassope a workshop was cleaned which held the remains of a furnace dating back to the 2nd century B.C.[55]. Here, in Kassope, in house 8, which is situated in practically the central part of the city, a smithy was found, which worked with both iron and bronze in the late 4th-early 3rd century B.C. (fig. 27)[56].

In the sanctuary at Nemea not far from the treasuries a row of small 25 casting pits was excavated dating to the 2nd century B.C. and containing traces of lead and bronze[57].

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[49] C. Kantzia, G. Zimmer, 1989; G. Zimmer, 1990, 91-99; 1990a; D. Haynes, 1992, 76.

[50] H.W. Catling, 1986, 98.

[51] E. Kakavoyiannis, 1985.

[52] H.W. Catling, 1985, 52-53.

[53] *Demetrias*, 1976, 90, Taf. XXXII; G. Zimmer, 1990, 103-115.

[54] D. Haynes, 1992, 76.

[55] G. Schneider, G. Zimmer, 1984; C.C. Mattusch, 1988, 228; G. Zimmer, 1990, 100-103; D. Haynes, 1992, 77-78; W. Hoepfner, E.-L. Schwandner, 1994, 119.

[56] G. Zimmer, 1990, 85-90; W. Hoepfner, E.-L. Schwandner, 1994, 119.

[57] G. Zimmer, 1990, 118.

Pits for casting bronze statuary and dating to the late 4th – early 3rd centuries B.C. have been found on Corfu[58].

A layer at Delphi of the 1st century B.C.-1st century A.D. has produced a miscast of a situle[59].

D. Williams has directed attention to finds of Hellenistic furnaces at Tarentum[60]. However, both a short field report by N. Degrassi and an article devoted to the topography of Tarentum[61] mention the discovery of several furnaces in the region of the necropolis, which, to judge by the photograph published, are characteristic pottery kilns.

In the Hellenistic layer at Mytilene two crucibles were found with the remains of bronze slag and iron slag[62].

At Galjub in Egypt a hoard was found containing the tools of a jeweller dating to the 2nd century B.C.[63]. Of special importance is a bronze workshop of the Ptolemaic period unearthed in the north-eastern courtyard of the Seth I temple complex in the northern part of the Thebaid necropolis[64].

Evidence of Hellenistic toreutic work includes finds of positive plaster casts and moulds which were mainly used in the manufacture of precious vessels at Mit Rahinet (Memphis), Begram, Aï-Khanoum, Pella, at various sites in Italy, and at Sala (Morocco)[65]. The dates of these finds are still disputed and it is also possible that they belonged to the craftsmen of the first centuries A.D., who worked in a period in which in toreutic art, as in sculpture, the era of copying of originals had begun; nevertheless, most of the casts reproduce Hellenistic prototypes[66].

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[58] G. Zimmer, 1990, 84-85.

[59] C. Rolley, 1986a, 24-26, fig. 3.

[60] D. Williams, 1989, 550, note 69.

[61] *Fasti Archaeologici* 12 (1959), 195, N 2952; F.G. Lo Porto, 1971, 381, pl. 65, 2.

[62] H. Williams, 1990, 504.

[63] A. Ippel, 1922; R. Higgins, 1980, 156.

[64] B. Scheel, 1988.

[65] O. Rubensohn, 1911; C. Reinsberg, 1980; F. Burkhalter, 1984; J. Boube, 1986.

[66] See the bibliography: S.Ju. Vnukov, S.A. Kovalenko, M.Yu. Treister, 1990. One of the subject on the plaster casts from Begram was recently identified as Iranian and it was maintained that it had been designed here by resident or immigrant Greek craftsmen working at the court of Gondophares (A.D.H. Bivar, 1990). However, this view was argued by M. Taddei in favour of traditional interpretation, although Taddei cannot dismiss the hypothesis that once the Begram specimen reached by way of trade what is now Afghanistan, it underwent a process of '*interpretatio iranica*', quite independent of the original meaning of the scene (M. Taddei, 1992).

In the Western Pontic area moulds were found in Histria for the casting of ornaments[67].

In the Northern Pontic area Hellenistic metalworkshops have not been excavated. However, separate finds of casting moulds, mainly for small articles in Olbia[68], Chersonessos[69], Pantikapaion[70], show that manufacture did take place at this time. Clay casts of mirrors and situla handle attachments of the 3rd century B.C., found in Chersonessos[71], should not be associated with the work of a coroplast; they may have been used as models by a toreut as were plaster casts with a similar function. Bronze stamps for hammering plaques[72] and a fragment of a stone matrix for stamping of gold foil calathos[73] prove that toreutic workshops existed in the capital of the Bosporan Kingdom. To judge from finds of moulds and stamps, jewelry workshops existed in other cities of Bosporus as well: in Tiritaka[74] and Tanais[75].

At Vani (Colchis) numerous fragments were excavated of bronze statuary, of the sculpture of a naked youth in Archaistic style. Evidence was unearthed of local bronze statue casting of the Late Hellenistic period, including an oval pit, probably associated with casting of a sculpture[76].

Archaeological discoveries in the capital of Hellenistic Armenia, Artaksata, have led to the conclusion that alongside the dwellings of warriors on the first mound were located armoury workshops, where arrowheads and spearheads were forged. Finds of crucibles of various shapes and dimensions for smelting copper alloys in the 1st and 8th mounds prove the existence of bronze workshops and the ateliers of jewellers and toreuts[77].

However by contrast with the previous period, there are considerably fewer excavated workshops. Could this trend be explained by some change in the topography of metalworking?

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67 S. Koxkowna, 1980, 119, pl. XIX, 2-3.

68 N.O. Lejpun'ska, 1984.

69 V.I. Kadeev, 1970, 49.

70 S. Koxkowna, 1980, 119-120; M.Yu. Treister, 1987b, 46-47; 1992a, 83-84.

71 V.K. Mal'mberg, 1892, 1-23, pls. I-III; *Keramicheskoe proizvodstvo*, 1966, 14-15, pl. V.

72 I.D. Marchenko, 1957, 166-168, fig. 2.7-8; S. Kołkowna, 1980, 122-123, pl. II.

73 M.Yu. Treister, 1989; 1990.

74 V.F. Gajdukevich, 1940.

75 S. Koxkowna, 1980, 119-120.

76 M.S. Pirtskhalava, G.G. Kipiani, 1986, 61-63, pls. 43-46; O.D. Lordkipanidze, 1989; 1991, 189-193, pls. 15-16; G.R. Tsetskhladze, 1991, 138.

77 B.N. Arakelyan, 1982, 22-23, 34.

### 4.2.1.1. *Metalworkshops in the Infrastructure of Cities*

Excavations at Kassope give some idea of the location of Hellenistic metal workshops. One such workshop is situated in direct proximity to the Agora[78], whereas another was found in almost the centre of the city (fig. 27)[79]. The latter workshop belonged to a smith in the late 4th-early 3rd century B.C.; it was located in one room of a house 14.4 × 15.6 m in dimension (see above concerning the transformation of the floorplan of the house on p. 194). The site of workshops was planned at the very beginning of the construction of a house. For instance, in house 8 the area for the workshop of a bronze-smith was planned at the time of the foundation of the city itself[80].

In Artaksata, founded in ca. 180 B.C., the workshops of the armourers were situated on the Acropolis. Two types of such workshop can be distinguished: rectangular constructions with a furnace, and larger workshops, consisting of three small rooms: one for a furnace, a main working area and an adjoining room, perhaps for the storage of charcoal[81]. Two building periods and two layers of destruction can be traced (the first at the turn of the 2nd and 1st centuries B.C. or in 34 B.C. during invasion of the Parthians, and the second during the siege of Corbulo in 59 A.D.), which prove that the armories at Artaksata were in use for a long time.

An arsenal at Aï-Khanoum is situated practically in the centre of the city near the foot of the Acropolis and to the east of the main street (fig. 38)[82]. It is remarkable that its groundplan stems from an oriental model[83].

### 4.2.2. *Workshops in the Light of the Stylistic Analysis of Metal Objects*

The leading toreutic centre of the Late Classical-Early Hellenistic period was Southern Italy. Local artistic traditions influenced the formation of late 4th-early 3rd century B.C. toreutic schools in Macedonia, Asia Minor, the Bosporan Kingdom and in Ptolemaic

78 G. Zimmer, 1990, 100-103; W. Hoepfner, E.-L. Schwandner, 1994, Abb. 96.
79 G. Zimmer, 1990, 85-90.
80 W. Hoepfner, E.-L. Schwandner, 1994, 119.
81 B.N. Arakelyan, 1982, 22-26, pl. X.
82 P. Bernard, 1980, 436, fig. 1.
83 C. Rapin, 1990, 337-338.

Egypt. There may have been both a direct migration of craftsmen, indicated by the close political ties between rulers (for example, during the reign of Ptolemy I the daughter of Berenike's I first marriage was given in matrimony to Agathokles)[84], and imitations as a result of the granting of inheritances or the presentation of diplomatic gifts—which included a large number of *objets d'art* made of precious metals and bronze—between one royal court and another[85]. Sometimes it is possible to trace indirect influences: for instance, the appearance of a floral pattern of Southern Italic origin in articles of the so-called Greco-Scythian style can probably be explained by the mediating role of Macedonia. At the same time one cannot categorically exclude the probability of direct contacts: we know of the grave stone of a Syracusan which was found in the necropolis of Pantikapaion; it is also possible to suggest that Southern Italic toreuts were at work in Macedonia[86].

In spite of the rapidly expanding Hellenistic *koine*, some shapes reflected regional peculiarities. This is also proved by observing the diffusion of objects, although, as a rule, if one maintains the existence of regional differences, one should operate with rather broad areas, comparing, for instance, "Northern Pontic" with "Macedonian", or "Syro-Seleucid" with "Ptolemaic". Typological studies allow one to distinguish the peculiarities of Macedonian, Seleucido-Syrian and Ptolemaic repertories mainly as a result of analysis of earrings, although the picture is not clear in Central Asia. Nor should one underestimate the influence of the repertory of Hellenistic shapes on local post-Achaemenid workshops[87]. However, only rare categories of objects demonstrate local peculiarities. For exmaple, the study of Hellenistic helmets by P. Dintsis has shown that no one type except for the so-called "*Ägyptische Kalksteinhelme*" had a limited area of circulation. One can make striking comparisons of the distribution maps of "Boeotian" helmets of the Classical (fig. 39) and Hellenistic (fig. 40) periods[88].

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[84] See about the contacts of South Italy, in particular, Tarentum, with Ptolemaic Egypt also: P.M. Fraser, 1972, 154-157.

[85] M. Pfrommer, 1982, 175; 1990, 34.

[86] M. Pfrommer, 1982, 149 ff.; 1983, 236.

[87] M. Pfrommer, 1990.

[88] P. Dintsis, 1986, XX, maps 1, 2.

## Attica

The certain level of decay of artistic craft in Athens in the Hellenistic era may be explained by the law against luxury adopted by Demetrius of Phalerum in 316 B.C. This prohibited the making of large grave steles, which led to the emigration of Attic sculptors to Egypt[89]. In Hellenistic times the role of Athens as a leading important artistic centre was considerably decreasing[90]. Among bronze plastic articles are the fragments of a gilt statue of Demetrius Poliorketes as a rider from the well on the Athenian Agora[91] and probably two bronze statuettes of boys from Dodona of an Early Hellenistic date which have been determined as Attic[92]. However, in general most Athenian sculptors worked outside Attica—in Pergamon, on Delos, Chios, and Rhodes[93].

The close similarity between silver vessels found in the necropolis of Pantikapaion along the Quarantine Road and Attic pottery from the "Western Slope of the Agora" style allows one to surmise that Early Hellenistic Athens remained a centre for the manufacture of silverware. The revival of this skill in ca. 100 B.C. is shown by the finds of an alabastron and a pyxis from Palaiokastro[94].

## Macedonia

The armories of Macedonia played an important role in the production of weapons in the Early Hellenistic period. Helmets of one of the most wide-spread types—Attic with peaks—may have been manufactured here, for the earliest examples of these come from the royal tombs at Vergina. A large number of them was wrought of iron. To judge by the scenes on the so-called Alexander sarcophagus from Sidon and emblems on Macedonian coins, Macedonian troops were equipped with other types of Hellenistic helmets as well: Boeotian, Phrygian, and those of the Pylos type (fig. 41)[95].

Using Southern Italic prototypes from the late 4th or early 3rd centuries B.C. onwards, Macedonian workshops manufactured

[89] G. Lippold, 1950, 310.
[90] B.S. Ridgway, 1990, 6-7.
[91] B.S. Ridgway, 1990, 126, 145, note 40 (bibliography), 349-350.
[92] B.S. Ridgway, 1990, 338, 348, note 39.
[93] B.S. Ridgway, 1990, 350.
[94] D. Strong, 1966, 119.
[95] G. Waurick, 1988, 177-179; cf. P. Dintsis, 1986, XX about the erroneous definition: "Macedonian" helmet; such helmets never existed in reality.

bronze and silver jugs with biconical bodies, and situlae with handle attachments in shape of Silene heads and spouts decorated with lion heads, which themselves probably led to imitations in Bosporus and at Chersonessos[96]. A krater found at Derveni was probably also produced in a Macedonian workshop of the second half of the 4th century B.C.; it had earlier been suggested that it was manufactured at Tarentum or in Alexandria[97].

In his recent publication of a Thessalian inscription on a krater G. Mihailov suggests that its owner was a tyrant of Pherae. Mihailov dates the krater to the period 358-344 B.C., however holds that the question of where it was manufactured is still open, but that it was probably somewhere in the Central Balkans or in the Propontid[98].

The workshops of Macedonia of the era of Philip II or of the period of the so-called Alexandrian Renaissance created a type of bronze decorative bust that was extremely popular in the Hellenistic and Early Roman periods and was used primarily for the decoration of the arm-rests of couches[99]. From the early 3rd century B.C. such articles were cast in workshops in Alexandria and Asia Minor. In the course of the evolution of such shapes in the 3rd-2nd centuries B.C. Macedonian workshops probably copied imported pieces of Asian Minor and Alexandrian workmanship. For example, bronze appliqué ornaments from the arm-rests of couches bearing busts of Dionysus and mule heads and found at Pella are considered to be of Northern Greek workmanship of the 3rd century B.C.which go back to Alexandrian or Asian Minor prototypes[100]. It was most probably in workshops in Northern Greece (Macedonia or Thessaly) in the late 3rd-early 2nd century B.C. that gold medallions for pyxid lids of the so-called "Statathos-Benaki" group were first manufactured, although it is still a matter of dispute where exactly such articles were produced (it has also been suggested that they were produced in workshops in Asia Minor and Alexandria)[101].

Gold earrings with human or animal heads, common in the Hellenistic era, most types of which borrowed from Italy (fig. 42,

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[96] M. Pfrommer, 1983, 239-265. See, e.g. vessels from Derveni: *Makedonen*, 1994, N 261-271.

[97] B. Barr-Sharrar, 1979; M. Pfrommer, 1982, 141.

[98] G. Mihailov, 1991.

[99] B. Barr-Sharrar, 1987, 160.

[100] B. Barr-Sharrar, 1987, 20-21.

[101] R.A. Higgins, 1982, 145-147, B. Barr-Sharrar, 1987, 125-131.

1), were manufactured in Macedonian workshops after the middle of the 4th century B.C. From here they found their way into the Eastern Mediterranean (fig. 42, 2)[102]. Gold earrings with negro heads, widespread in Macedonia, Illyria and Italy may have been originally created in Macedonian ateliers in the last quarter of the 3rd century B.C., where they were made until the middle or even the last part of the 2nd century B.C. (fig. 43, 1)[103]. Bracelets and rings in the shape of snakes were also produced in Macedonian workshops of the 3rd century B.C.[104].

The evolution of the "Heraclean knot" motif in Hellenistic jewelry probably began in the workshops of Macedonia, where from the second half of the 4th century B.C. motifs were reworked which were earlier characteristic of ateliers of the Pontic circle. With a certain degree of hesitation M. Pfrommer localises these workshops to the historical centre of Macedonia, to Pella or to Vergina[105]. At the same time in the late 4th century B.C. Macedonian workshops borrowed from Asia Minor a type of a chain with a clasp in the shape of lion heads, the central part of which was decorated with the "Heraclean knot". In the first half of the 3rd century B.C. this became widespread throughout the Eastern Mediterranean[106]. Also in the late 4th century B.C. Macedonian workshops began to imitate the shape of a bracelet decorated with the heads of animals in its ends, originally Achaemenid, which had been manufactured from the late 5th century B.C. by Greek workshops in the Achaemenid satrapies of Asia Minor and probably in the Northern Pontic area[107].

Some bronze statuettes and statues (for example, the so-called "Ephebe from Agde") have been identified with portraits of Alexander the Great[108], including some in Late Hellenistic reproductions[109], or Demetrius Poliorketes[110], although it is arguable whether a local Macedonian school of bronze sculpture existed[111]. A large bronze statuette of Poseidon found at Pella in a

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102 M. Pfrommer, 1990, 144-146.
103 M. Pfrommer, 1990, 185-187, Abb. 36.
104 M. Pfrommer, 1990, 128-132, Abb. 19.
105 M. Pfrommer, 1990, 11-12, Abb. 1; 16, 77.
106 M. Pfrommer, 1990, 81-82, 94, Abb. 14.
107 M. Pfrommer, 1990, 99, 101-104.
108 V. von Graeve, 1985; C. Rolley, 1988a; F. Queyrel, 1990, 130, N 224, 233; 134, N 258.
109 W. Wohlmayr, 1988.
110 F. Queyrel, 1990, 136, N 274-276, 278; B.S. Ridgway, 1990, 108.
111 B.S. Ridgway, 1990, 353-354.

complex with a *terminus ante quem* of 168 B.C. is perhaps of local manufacture[112].

Thessaly

Analysis of a late 4th-century B.C. bronze matrix for the striking of plaques with images of Thetis and Scylla found close to Larissa Cremaste in Southern Thessaly allows one to hold that there was a toreutic centre here. Comparanda, originating from Illyria, Macedonia, Southern Italy and the North Pontic area show that there were relations between these artistic centres in the Early Hellenistic period[113]. Such relations also characterize the numerous finds of Thessalian jewellery of Hellenistic times[114].

Chalcis

The series of four bronze lid-mirrors dating to the first half of the 3rd century B.C. and found in Demetrias in Thessaly may be attributed with high probability to a Chalcidian workshop; however, W. Züchner does not rule out that they were cast on the spot imitating imported originals[115].

Asia Minor

The question of whether a toreutic atelier existed at Lampsacus in the very end of the 4th century B.C. arose as a result of the attribution by I.Venedikov of a gold phialai from the Panagyurishte treasure with a graffito designating its weight in the staters of Lampsacus[116]. Some scholars accept this view[117]. However soon af-

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[112] C. Rolley, 1986a, 198-199, fig. 172; B. Barr-Sharrar, 1990, 218-219, fig. 16; R. Thomas, 1992, 126-127, Abb. 124.
[113] See M.Yu. Treister, 1994, 85-92 with references.
[114] S. Miller, 1979, 49-51 with references; cf. R.A. Higgins, 1982, 143-151.
[115] W. Züchner, 1942, 173-174.
[116] I. Venedikov, 1961.
[117] See, e.g.: H. Luschey, 1983, 319; H. Steierlin, 1986, 21-22. Cf., however P. Zazoff, C. Hocker, L. Schneider, 1985, 599-616, esp. p. 616: "Die Gefässe von Panagjurište sind als Rinngefässe spezifisch thrakisch in ihrer Grundfunktion, sie sind ebenso thrakisch in der Anverwandlung teilweise fremde, nicht als Rhyta gedachter Gefässformen für diesen Gebrauch. Als Umformulierung ins Thrakische erweist sich auch die Verwendung griechischer Elemente im Reliefdekor... Die Gefässe nicht nur in ihrer Funktion und Wirkung, sondern auch ihrer Herstellung nach als thrakisch anzusehen sind...". Cf. M. Pfrommer, 1993a, 343-344, Anm. 27.

ter its first publication H.A. Cahn expressed doubts about the Lampsacian manufacture of the Panagyurishte phialai and these have recently been repeated by English scholars[118], some of whom have suggested that it has an Attic origin[119]. The view expressed by H.A. Cahn that it was manufactured in a Thasian workshop seems unlikely[120]. However, analyses of silver rhyta in the shape of animals' heads prove that at least several toreutic workshops co-existed in Asia Minor in the late 4th century B.C.: one of these ateliers may have been situated in the area of the Hellespont[121]. Such workshops also existed in cities on the southern coast of the Black Sea; this has been shown by the find of a hoard near Sinope. M. Pfrommer suggests a reason for the influence of Southern Italic toreutics on those of Asia Minor: between 322 and 306 B.C. the tyrant of Heraclea on Pontus received an inheritance from the Sicilian tyrant Dionysius II, and it was for this reason that the master of the Panagyurishte vase could draw inspiration from works of art from Magna Graecia, coins of the Syracusan mint etc.[122]. Some Early Hellenistic toreutic workshops in Northern Asia Minor manufactured silver vessels with Greek shapes, however they were decorated with Achaemenid and Egyptianised patterns. Such a workshop had probably been established already in the late 5th or early 4th century B.C. at the court of one of the satraps. This trend was arrested in about 300 B.C.[123]. Jewelry workshops also existed in Early Hellenistic Asia Minor. The existence of such an atelier is proved by analyses of the Kyme treasure. This workshop was probably of the "father-son" type[124].

Pliny (N.H. XXXIII. 156) makes mention of Poseidonius of Ephesus, who manufactured silver vessels in the time of Pompey[125].

C. Rolley sees possible local workmanship[126] in a large bronze figure of Pan dated to the late 4th-early 3rd century B.C. found on the south coast of the Black Sea as well as in a sculptural group of

118 H.A. Cahn, 1960; D. Lewis, 1986, 76-77; M. Vickers, 1989, 110, N 3.
119 D. Lewis, 1986, 77.
120 M. Pfrommer, 1983, 269, Anm. 172.
121 M. Pfrommer, 1983, 281.
122 M. Pfrommer, 1982, 122, Anm.4; 1983, 283-284.
123 M. Pfrommer, 1989, 283-284; 1990a, 208-209.
124 D. Williams, 1991.
125 D. Strong, 1966, 120.
126 C. Rolley, 1986a, 203-204, fig. 176.

Theseus struggling with the Minotaur of the second half of the 2nd century B.C. which originated in the surroundings of Aphrodisias[127].

An appliqué ornament from the arm-rest of a couch and a statuette of a running satyr from the Mahdia shipwreck probably belong to the output of a late 2nd century B.C. workshop in Asia Minor. More complex is the question of the place of origin of a bronze herm with the signature of Boethos of Chalcedon which was also found there[128]. This has been attributed to the work of either Asia Minor or of Athens[129]. The name given has also been correlated with a contemporaneous signature on statue bases of the first half of the 2nd century B.C. from Delos and Rhodes, although it is unclear whether the master of the herm was at the same time the author of the sculptures[130], or the herm should be dated to the second half of the 2nd century B.C. without attempting to define the place where it was manufactured[131].

## Pergamon

The centaur protome and silver bowls from Cività Castellana and some medallions from Miletopolis have been attributed to Pergamene workshops[132]. However, an analysis of the decoration of the Cività Castellana bowls undertaken by M. Pfrommer has shown that this has nothing in common with the ornamental style of Pergamon and that the pieces belong to the production of a Seleucid workshop of the second half of the 2nd century B.C.[133]. Silver relief bowl medallions with grasshoppers found in a 2nd century B.C. hoard at Nihawand in Iran are probably of Pergamene production—their nearest stylistic comparanda are to be found in the mosaic from the palace of Eumenes II[134].

The Attalids probably borrowed from the Ptolemies the custom of using rings bearing portraits of representatives of the ruling dynasty. One such group of rings includes portraits of Philetairus and Eumenes II, which are typologically complemented by a se-

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[127] C. Rolley, 1986a, 210-211, fig. 182.
[128] G. Lippold, 1950, 352; G. Hellenkemper Salies, 1992, 510 ff.
[129] B. Barr-Sharrar, 1987, 24-26; 1990, 218.
[130] J.J. Politt, 1987, 140-141; B.S. Ridgway, 1990, 232-233, 243, note 23.
[131] F. Braemer, 1979, 33; C. Rolley, 1986a, 54.
[132] D. Strong, 1966, 119.
[133] M. Pfrommer, 1987, 112.
[134] A. Oliver, 1977, 74, N 38-39.

ries of rings with an enthroned Cybele (8 finds from the territory of the Bosporan Kingdom, 3 perhaps from Asia Minor, and 1 from Thrace)[135], whose cult was extremely popular at Pergamon, where numerous examples in sculptures and small plastics have been found[136].

Although lately many scholars have considered that in the Hellenistic period Pergamon seized the place of Athens in the Greek artistic world (the theory of "Pergamenocentrism") (fig. 44)[137], this city could hardly have been a centre of attraction for Greek sculptors working in bronze in the Early Hellenistic era[138], in spite of the fact that sculptures of the Attalids were installed at Delphi, Sicyon, and Athens[139]. Three signed bases with dedications by Attalus to Zeus and Athena originate from the sanctuary of Athena on the acropolis of Pergamon. On one of these bases preserves the signature of the sculptor Epigones[140]. Holes on the upper surface of the bases seem to prove that the statues were cast in bronze, although this view has recently been criticised[141]. The bases concerned are associated with Pliny's notion (N.H.XXXIV. 84) that certain artists, namely Isogones, Phyromaches, Stratonikes and Antigones, depicted the battles of Attalus and Eumenes against the Galatians[142].

Later on, in the first half of the 2nd century B.C., there existed at Pergamon a prominent school of sculptors working in bronze[143]. Some bronze figures, including the famous statue from Termi Museum in Rome, are said to be images of Attalus III[144]. According to Pompeius Trogus (XXXVI. 4), Attalus III himself learned the craft of bronzecasting[145]. One would suppose that some examples of artistic utensils were also manufactured in Pergamene workshops, including a satyr figure dated to ca. 160-150 B.C.

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135 M.Yu. Treister, 1982, 69; F. Naumann, 1984, 276-278.
136 F. Naumann, 1984, 247-256; 269-276.
137 H.-J. Schalles, 1985, 20-22; J.J. Politt, 1987, 281-283; B.S. Ridgway, 1990, 6-7.
138 B.S. Ridgway, 1990, 357.
139 J.J. Politt, 1987, 282-283.
140 See about the articles of "Epigones workshop": H.-J. Schalles, 1985, 77-78.
141 J.R. Marszal, 1991.
142 J.J. Politt, 1987, 83-85; B.S. Ridgway, 1990, 285-287; E. Rice, 1993, 232.
143 G. Lippold, 1950, 353-354.
144 N. Himmelmann, 1989, 142; F. Queyrel, 1990, 141-142, N 313-315.
145 C. Rolley, 1986a, 204, 208, fig. 180; B. Barr-Sharrar, 1990, 220, fig. 19.

## Delos

Of the Cycladic islands Delos was the most important centre for the manufacture of statues in the Hellenistic period; the most important monuments were probably made after 166 B.C., when following a decision by the Roman senate the island was given to Athens. A considerable number of statues in the Delian sanctuary, dedicated by the Antigonids and the Attalids, were cast in bronze. Recently the view was expressed that a group of bronze statues found in 1959 at Piraeus were not war trophies readied for transportation by sea, but sacred sculptures which had been carried from Delos to Athens to safeguard them in the period of the Mithridatic Wars against Sulla in 88-86 B.C.[146]. In spite of the fact that the dating of all four of these bronze sculptures, especially an Apollo executed in the Archaic (?) or Archaistic (?) style, is in the final analysis unclear[147], it seems possible that they were cast simultaneously to a single order for the sanctuary of Artemis[148].

Delos was also an important centre for the manufacture of bronze appliqué ornaments for couches (Plin. N.H. XXXIII. 144; XXXIV. 9). Plaster moulds for casting bronze legs for couches found in a layer of the second quarter of the 1st century B.C. prove the existence of a Delian workshop in approximately the last quarter of the 2nd-first quarter of the 1st century B.C.[149]. S. Faust suggests that this Delian workshop existed at the period of Delos' prosperity between 166 and 88 or 69 B.C., although she seems unable to localise other ateliers where bronze details of couches were cast[150]. According to G. Siebert[151], the bronze masks of Silene and Dionysus which were used as furniture decorations are also products of a late 2nd-early 1st century B.C. Delian workshop. A bronze herm in the form of a satyr figure found during the excavation of a house destroyed in a fire in the second quarter of the 1st century B.C. in Delos is probably also the work of Delian craftsmen[152].

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146 G. Dontas, 1982.

147 See: C. Rolley, 1986a, 44, fig. 17; C.C. Mattusch, 1988, 74-79.

148 B.S. Ridgway, 1990, 363; cf. the point of view of S. Karouzou about the attribution of a female figure not as Artemis, but a poetess Telessyle; the sculpture is considered to be a work of a late 4th- early 3rd century B.C. Argive master. See: S. Karouzou, 1979.

149 G. Siebert, 1973, 581-587; B. Barr-Sharrar, 1987, 26.

150 S. Faust, 1989, 131.

151 G. Siebert, 1979; 1988, 276-277.

152 B. Barr-Sharrar, 1990, 219-220, fig. 18.

## Rhodes

The statue of the Colossus fashioned by Chares, an apprentice of Lysippos, installed in 281 B.C. and destroyed in the earthquake of 228 B.C. was one of the most famous articles of ancient bronzeworking[153]. After the earthquake a large-scale programme of building and artistic reconstruction of the city was begun. It is owrth noting that the creation of a colossal statue 70 cubits high was financed by money received from the sale of siege engines left behind by Demetrius Poliorketes after his unsuccessful siege of Rhodes 56 years earlier (Plin. N.H: XXXIV. 41). Among the Early Hellenistic bronzes cast in Rhodes, I have to mention a large quadriga of Helios, of Lysippean workmanship (Plin. N.H. XXXIV. 63), which was for a long time identified with the famous sculptural group at St Mark's; at present most scholars agree that the latter monument should be dated to the Roman era, however, from time to time views emerge giving it a Hellenistic date[154]. To my mind J. Bergemann was probably right in comparing the quadriga from St Mark's to the fragmentary quadriga found at Cartocetto, and concluding that it was manufactured in ca. 50-30 B.C. on the basis the 4th century B.C. original[155]. Lysippos, who cast some famous bronze sculptures for Rhodes, is considered to be the architect of the local school of bronze sculpture[156].

According to A.Linfert, the Rhodian school was not openly active until 200 B.C.[157]. Of the local schools of bronze statuary, the school of Chares probably continued in operation, to judge by finds on Lindos of several statue bases, although these are of later dates[158]. Ancient writers and the signatures preserved on statue bases of the 3rd-first half of the 2nd century B.C. show that mas-

[153] H. Maryon, 1956; R.A. Higgins, 1988; D. Haynes, 1992, 121-128; E.Rice, 1993, 235-239.

[154] See, e.g.: V. Galliazo, 1985; B.S. Ridgway, 1990, 58, 70-71, note 43.

[155] J. Bergemann, 1988.

[156] G. Lippold, 1950, 297; H. Maryon, 1956, 68 ff.; J.J. Politt, 1987, 55-58; cf. R. Kabus-Preisshofen, 1988, 696, Anm. 88.

[157] A. Linfert, 1976. The recently published study by G.C. Goodlett has shown, that it is possible to identify eight workshops on Rhodes between ca. 340 B.C. and 7 A.D. Although families were the core of the longest-lived workshops, all traceable workshops involved sculptors unrelated to the principals. In some cases, the outside sculptors bore the same ethnic as the principals; in other instances, they were originally from different cities. Most of the foreign sculptors who settled on Rhodes were from Asia Minor. See: V.C. Goodlett, 1991.

[158] B.S. Ridgway, 1990, 361.

ters from Cyprus, Samos, the Troad and other regions of the Greek world arrived on Rhodes to cast statues[159]. There are reasons for suggesting that the Rhodian school of bronze sculpture was characterised by a stable evolution[160]. The bronze head of the "Philosopher" from the early 1st century B.C. shipwreck near Antikythera, traditionally dated to the 2nd century B.C., has recently been reconsidered: thus B.S. Ridgway suggests that it was cast in 340-330 B.C., M.Pfrommer in the 3rd century B.C.[161], while S.Karouzou identifies it with a portrait of Bion of Borysthenes and considers it to be a Rhodian work of ca. 240 B.C.[162]. The bronze figure of sleeping Eros possibly from Rhodes in the collection of the Metropolitan Museum of Art should be probably considered as a work of the Rhodian school. Even if it is not a Hellenistic original, it may be a Roman copy of a prototype which dates back to between the mid-3rd century B.C. to the turn of the 2nd-1st centuries B.C.[163]. The statue of a praying youth of the late 4th-early 3rd century B.C. in Berlin. which was found on Rhodes and had been brought by 1503 to Venice[164], is considered to have been executed by Boides, the son and apprentice of Lysippos[165]. The figure of the so-called Apollo Piombino, probably the work of Menodotes of Tyre and— **-phonos** of Rhodes is also said to be Rhodian work of the 1st century B.C.[166].

A peculiarity of the Rhodian sculptural school and characteristic of articles of high artistic value is, according to B.S. Ridgway, the fact that public monuments were cast in bronze rather than carved in marble[167].

A Rhodian school of small bronze plastics has supposedly been identified. Some of the fourteen bronze figures, which were described by H.Kyrieleis as articles of Alexandrian workmanship, may have been executed by invited Rhodian craftsmen[168].

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[159] G. Lippold, 1950, 361.
[160] B. Barr-Sharrar, 1990, 221-222.
[161] B.S. Ridgway, 1990, 57, 70, note 41; M. Pfrommer, 1987a, 124-129.
[162] S. Karouzou, 1985, 207-213.
[163] G.M.A. Richter, 1943; J. Mertens, 1985, 52, N 34; J.J. Politt, 1987, 129-130, fig. 135; B.S. Ridgway, 1990, 327, 344, note 26 (with bibliography), pl. 164.
[164] M. Perry, 1975.
[165] See: R. Kabus-Preisshofen, 1988, 696.
[166] B.S. Ridgway, 1967; 1984, 22-23, note 69; 1990, 227-228, 241-242, note 20.
[167] B.S. Ridgway, 1990, 362.
[168] B. Barr-Sharrar, 1990, 220-223.

Samos

To judge from bases with inscriptions bronze statues of Hera were installed here which were cast by Themistocles, son of Xenokrates, and probably an apprentice of Lysippos, as were statues of Berenike, the daughter of Ptolemy II (ca. 281-260 B.C.) and sculptures by Dioskurides in ca. 200 B.C. However H. Horn holds that ancient writers never mention the name of a Hellenistic sculptor of Samian origin[169].

Kos

There was a local school of sculptors which produced statues of sometimes very good quality: more than half of known sculptures from the Hellenistic and Augustan periods were cast in bronze. However Koan sculptors did not sign their works[170].

Egypt

An Alexandrian toreutic school was being established in the Early Hellenistic period. Alexandrian production is known from finds from the Tuch el-Karamus hoard (a temple inventory containing a rhyton with a Pegasus protome, silver bowls, a golden torque and amulets) and other finds dated to the 4th-first half of the 3rd century B.C. It is characterized by the combination of various artistic shapes and styles: traditions of Ancient Egyptian, Achaemenid, and Greek art[171]. However we should not rule out the possibility that some Early Hellenistic toreutic pieces were produced by the Memphis school. As P.M. Fraser surmised, a mixed population of *Hellenomemphites* lived at Memphis; they may have been the creators of the articles discussed here. But others too worked at the same crafts and Egyptian documents record native Memphite men and women who were engaged in metalworking[172]. With the gradual decline of Memphis Alexandria became the most important metalworking centre, especially in the Late Hellenistic period[173].

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169 See: B.S. Ridgway, 1990, 360.
170 K. Höghammar, 1993.
171 D. Strong, 1966, 120; J.J. Politt, 1984, 255-256; M. Pfrommer, 1987, 142-159.
172 P.M. Fraser, 1972, 136-137; D.B. Thompson, 1988, 67.
173 P.M. Fraser, 1972, 136-137. See about the Greeks in the Ptolemaic Egypt: N. Lewis. 1986; G. Gagsteiger, 1993, 24-25.

A peculiar artistic style (the so-called *Alexandrinisches Landschaftsstil*) was in evidence in Alexandrian toreutics[174]. Analyses of the decoration of the so-called *coppa Tarantina* and the Treasure of Tarento prove that they were made by a toreut who originated in Magna Graecia and worked in Egypt in ca. 280-260 B.C., even possibly to commissions from the Ptolemaic court[175]. The *Coppa Tarantina* used to be considered to be a Southern Italic piece of the late 4th-mid-3rd century B.C., although some scholars have stressed the influence of Alexandrian toreutics[176], while the group of vessels from the Rothschild collection has been seen as a creation of Tarentine or Alexandrian schools, dating from the early 3rd to the late 2nd-early 1st centuries B.C.[177].

Ptolemaic workshops produced some variants of gold earrings, chains and bracelets with protomes of lion-headed griffins, whose horns were turned down, like those of Achaemenid lion-griffins. The appearance of this motif in Egypt can be explained by the intensive contacts between Asia Minor and the Ptolemaic state. This pattern was common from the early to the mid-3rd century B.C. but was exclusive to Egypt and to the regions which formed part of the Ptolemaic Kingdom, mainly Cyprus (fig. 43, 2)[178]. There is a contemporary area of distribution for earrings with goat-heads: finds from Egypt and Cyprus predominate, although some isolated pieces originate from the Pontic area and Greece(?). This type of ornament emerged in about the middle of the 3rd century B.C. and was to last throughout the following century (fig. 45, 1)[179]. It was probably also in Ptolemaic workshops in the second quarter of the 3rd century B.C. that a type of earring with a bull's head was created: these have been principally found in Egypt, Cyprus, and Syria, although some specimens are known from Greece, Asia Minor, and the Northern Pontic area as well as Italy. This type was also common during the next century. The predominance of this type of ornament in the Egypto-Syrian region and on Cyprus is explained by the fact these territories fell into the Ptolemaic sphere of interests[180]. Products of 2nd-century B.C. Ptolemaic ateliers include earrings with dolphin-heads, finds of

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174 C. Reinsberg, 1980, 283-292; C. Rolley, 1986a, 214-215.
175 M. Pfrommer, 1987, 21-22; 132-136; 160-167. See also: E. Ghisellini, 1993.
176 See: M. Pfrommer, 1987, 247, KBk 17.
177 See: M. Pfrommer, 1987, 160, Anm. 1048.
178 M. Pfrommer, 1990, 87, 104-106, 157-160, Abb. 17, 27.
179 M. Pfrommer, 1990, 172-175, Abb. 32.
180 M. Pfrommer, 1990, 162-168, Abb. 29.

which—except for a pair from Bosporus—are concentrated in Egypt and Cyprus (fig. 45, 2)[181]. Bracelets in the shape of snakes were also made in Ptolemaic workshops: in the Early Ptolemaic period these were very similar to Macedonian prototypes, however, from the late 3rd century B.C. a characteristic type of a bracelet with two snake heads was being produced there[182].

It is thought that bronzeworking was not one of the major crafts of Ptolemaic Egypt[183]. At the same time, analyses of bronze objects provide some points of interest. The most significant contribution to the development of small plastics is the creation of a series of "generic" and grotesque statuettes which represent a range of Alexandrian inhabitants of various social and ethnic backgrounds[184]. Bronze grotesques and negro figures are unanimously considered to be the products of an Hellenistic or Roman Alexandrian atelier. Finds of such statuettes in Gaul force us to ask what sort of goods they manufactured: had they specially geared themselves to producing for export, like the pottery workshops of Laconia of the 6th century B.C.?[185]

Analysis of bronze plastics with Dionysiac subjects allows us to identify items from Egyptian workshops: they are more homogenous than articles from other schools both in terms of their geographical and their chronological distributions. Egyptian bronzes were certainly imitated, which makes it rather difficult to decide how to distinguish originals from imitations[186].

A pivotal piece in the dating of the Alexandrian school of bronze sculpture is a large statuette from the Metropolitan Museum, the so-called Baker dancer, which has traditionally been dated to between the mid-3rd and the mid-2nd century B.C., or to between 225 and 175 B.C.[187]. However, a reconsideration of the dates of complexes from the Athenian Agora, where similar terracotta figurines have been found, allows us to suggest that the statuette from the Metropolitan Museum should be seen as a standard piece for determining the chronology of objects of the Alexandrian school of the last quarter of the late 3rd century

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[181] M. Pfrommer, 1990, 178-179, Abb. 34.
[182] M. Pfrommer, 1990, 135-137.
[183] C. Rolley, 1986a, 213.
[184] C. Rolley, 1986a, 217-220.
[185] C. Rolley, 1979, 16-17.
[186] I. Manfrini-Aragno, 1987, 183.
[187] D.B. Thompson, 1950; see also R. Thomas, 1992, 129-131, Abb. 130 with references Anm. 270, who suggests dating to the mid-3rd century B.C., although not excluding the possibility of the mid-2nd century date.

B.C.[188]. A bronze relief with an image of Artemis, which stands before an altar from the Delian sanctuary, corresponds exactly to the description of the inventory of the sanctuary at Agatha Tyche, which was originally a Philadelpheion dedicated to Arsinoe II. On the basis of stylistic analysis the relief has been dated to ca. 220-210 B.C.[189].

The fine statuette of a youth found in the Fayum is held to be Alexandrian work of the 1st century B.C.[190]. In the Late Hellenistic period one popular subject in Alexandrian art was the representation of dwarfs and cripples[191].

Bronze busts of Athena, Selene, and Nike and grotesques from the Mahdia shipwreck, earlier dated by U. von Shönebeck and H. Küthmann to the mid-1st century B.C., are considered by B. Barr-Sharrar to have been manufactured in the last quarter of the 2nd century B.C. in an Alexandrian workshop[192]. They may go back to Alexandrian originals of the first half of the 2nd century B.C., and are examples of Alexandrian court art which were distributed as presents[193].

Other characteristic groups of Alexandrian small bronze plastics of the 2nd-1st century B.C. were representations of priests of the cult of Isis[194] and pairs of fighting athletes, which may represent the Ptolemaic kings[195].

Analyses of bronze rings with portraits of representatives of the Ptolemaic dynasty on their bezels and a group of typologically similar rings with emblems of Athena Promachos, Serapis etc., together with a spectroscopic study of rings and Ptolemaic coins offer grounds for the assumption that the ring bezels and coin dies may have been carved by the same engravers and that the rings may have been cast in an Alexandrian mint in the 3rd century B.C. Most of the rings discussed come from the Bosporan Kingdom, thus proving the existence of close political ties between the Lagids and Spartokids. Such rings are also known in other materials, including gold[196]. Recently it was supposed that the rings had

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188 J.J. Politt, 1987, 272, fig. 292; B.S. Ridgway, 1990, 219-221.

189 C. Reinsberg, 1980, 142-143; C. Rolley, 1986a, 215; B.S. Ridgway, 1990, 319, pl. 158.

190 R. Thomas, 1992, 132-133, Abb. 132.

191 See, e.g. R. Thomas, 1992, 137 ff.

192 B. Barr-Sharrar, 1987, 25.

193 H. Wrede, 1988, 109-110; cf. S. Pfister-Hass, 1991; R. Thomas, 1992, 139-140.

194 R. Thomas, 1992, 145, Abb. 149.

195 H. Kyrieleis, 1973; S. Lehmann, 1988, 294-298; R. Thomas, 1992, 149-151.

belonged to Bosporan mercenaries in Ptolemaic service[197], although this idea does not, to my mind, explain the full variety of finds that reflect the relations between Bosporus and Egypt, for instance, a fresco with the picture of an ambassador's ship from the Nymphaion [198], nor does it tell us why these rings were distributed mainly in Bosporus, but not in other main regions from which the Ptolemies recruited their armies. Bronze appliqué ornaments from the arm-rests of couches bear decorative busts, some of which have been identified with portraits of Ptolemy II[199] and Arsinoe III[200]. These and a chest from Pompei with busts showing Ptolemy II as Dionysus, Ptolemy III as Hermes, Ptolemy IV as Apollo and their spouses[201] were like the rings instruments of political propaganda[202] and were also probably made in Alexandrian workshops. We know of a small group of bronze statuettes, which probably represent the Lagids, including Ptolemy II as a rider[203], Ptolemy III in the likeness of Heracles and Hermes Enagonios[204], Arsinoe III as Demeter[205], and Ptolemy XII[206]. However, it is possible that some of these statuettes were cast by Rhodian craftsmen.

It has proved extremely complicated to interpret and date the set of plaster casts and moulds from Mit-Rahinet which were made on the basis of reliefs of various utensils, vessels, mirror cases, arms and armour. O. Rubensohn dated these to the reign of Ptolemy Euergetes, i.e. to approximately the beginning of the last quarter of the 3rd century B.C., while most of the metal prototypes, which he considered to be articles of Southern Italic, Asian Minor, and mainland Greek manufacture, were attributed to the

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196 M.Yu. Treister, 1985. See also E. Ghisellini, 1993, 61-62, 69, note 110 with references.

197 Yu.N. Litvinenko, 1991.

198 See, e.g.: N.L. Grač, 1987.

199 B. Barr-Sharrar, 1987, 96; cf.: C. Rolley, 1988, 355.

200 B. Barr-Sharrar, 1987, 106; B.S. Ridgway, 1990, 147, note 47.

201 F. Queyrel, 1984.

202 F. Queyrel, 1984; 1990, 102-103, N 21-22; C. Rolley, 1988, 355.

203 H. Kyrieleis, 1975, 166, N B2, Taf. 10,1-3; cf. N. Himmelmann, 1989, 232f.; H.P. Laubscher, 1991, 230 ff., Taf. 49; R. Thomas, 1992, 125, Abb. 121.

204 Statuettes from the museums of Naples and Alexandria: S.A. Muscettola, 1979, pls. 36-37; statuette from Stuttgart: S. Lehmann, 1988, 290-293; F. Queyrel, 1990, 123, N 165; statuette from Bonn: H. Kyrieleis, 1975, 36ff., 170, N C15; Taf. 26, 6-8; 27, 1-4; N. Himmelmann, 1989, 233f.; R. Thomas, 1992, 123-124, Abb.119; statuette from the Louvre: H.P. Laubscher, 1992.

205 S. Besques, 1981; F. Queyrel, 1990, 123, N 166.

206 H. Seyrig, 1968; F. Queyrel, 1990, 122, N 159.

4th-3rd century B.C.[207]. G.M.A. Richter thought that all the casts had been made in the first centuries A.D., largely from Hellenistic utensils, which were still in existence at that time[208]. According to C. Reinsberg[209], the casts belonged to the workshop of a toreut which had existed from at least the third quarter of the 4th century B.C. to the end of the Hellenistic era, and which switched its operations in the first centuries A.D. by starting up the manufacture of bronze statuettes and bronzeware instead of objects made of precious metals. Judging by the chronological distribution of the casts, its main activities can be dated to the 3rd century B.C.[210]. However, F. Burkhalter considers it impossible that a toreutic workshop in the Greek tradition like this one could have existed for so long at Memphis and holds that there is nothing to prove that Hellenistic plaster casts could not have been used in the Roman era. Nevertheless, she does not rule out the probability that such a workshop co-existed in the pre-Roman period with the workshops of a toreut and a bronzemaker[211].

That helmets of the Boeotian type were manufactured in early Ptolemaic Egypt is proved by limestone models of the late 4th-first half of the 3rd century B.C., which originate from Memphis[212]. It is useful to compare this find with what we know about the presence of Boeotians, including *cleruchs*, in Ptolemaic Egypt[213]. Furthermore, the series of so-called "*Ägyptische Kalksteinhelme*" found in Mit-Rahinet also belongs to the Early Ptolemaic period[214]. It has been maintained that helmets of the Boeotian type were used to equip the cavalry, while those of the "Ptolemaic" type were probably designed for infantry use[215]. There are thus reasons to see Memphis as a centre for the arms industry in Ptolemaic Egypt[216].

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207 O. Rubenensohn, 1911, 87-88.

208 G.M.A. Richter, 1958.

209 C. Reinsberg, 1980, 244-253.[210] C. Reinsberg, 1980, 278.

211 F. Burkhalter, 1981, 691-693.

212 P. Dintsis, 1986, 18, 29, 172, Taf. 3, 7; 200, N 5; G. Waurick, 1988, 161-162, Abb. 29; G. Gagsteiger, 1993, 8-11.

213 D. Hennig, 1989.

214 P. Dintsis, 1986, 169-177, 298-303, Taf. 76-78. G. Gagsteiger (1993, 7, Anm. 38, 12 ff.) identifies two types of the so-called "Ptolemaic" helmets, although stating that designation "Ptolemaic" is tentative, while ancient sources did not preserve evidence of a specific type of Ptolemaic helmets.

215 G. Gagsteiger, 1993, 21.

216 D.J. Thompson, 1988, 65-66: "Memphis had long been an armament cen-

Syria

The wealth of the Seleucids included a large collection of vessels made of precious metals (Cicero. Verr. IV. 62). The centres in which they were manufactured were probably Antioch (Athen. V. 193D) and other Syrian cities[217]. In 258 B.C. Seleucus I addressed a letter to the *demos* and *boule* of Miletus, in which he listed his gifts to the Didymeion, which included items of gold and silver: gold phialai, rhyta, oinochoai, a psikter, a plate weighing in total 14 kg, silver skythoi and a krater weighing about 40 kg, and bronze candelabra[218]. One might assume that some at least of these valuable objects were made in the royal workshops.

In ca. 295 B.C. Eutychides of Sicyon, an apprentice of Lysippos, created a statue of the Antiochian Tyche, the personification of the city which gave rise to numerous imitations in the form of small bronze plastics, although these especially widespread in the first centuries A.D.[219].

It is perhaps a portrait of Seleucus I that decorates a herm found at the Villa of the Papiri at Herculaneum[220]. The bronze bust of a hero on the appliqué ornaments on the arm-rest of a couch found in Pella has been identified by B. Barr-Sharrar as portrait of Antiochus III (223-187 B.C.). It was supposedly cast in a workshop in Asia Minor[221]. A large bronze statuette from Kansas City is usually seen as a representation of Seleucus IV in the guise of Heracles[222]. A fragmentary bronze head from Shami in Susiana has been identified with portraits of Antiochus I, II, IV, and VII or Seleucus II[223]. C. Rolley holds that Seleucid workshops of the 2nd-century B.C. were characterized by the manufacture of large-scale bronze statues as well as of bronze and terracotta figurines, based

tre and though, with the arrival of the Greeks, new models may have been imported from abroad, Memphite manufacture continued to meet home needs".

217 G. Downey, 1961, 22; D. Strong, 1966, 120-121.

218 C. Gaspari, 1970; F. Burkhalter, 1979, 75; G. Petzl, 1991; M. Vickers, 1992, 53-71.

219 See: C. Rolley, 1986a, 198, N 292; B.S. Ridgway, 1990, 233 ff., 243, note 24.

220 C. Rolley, 1986a, 201, fig. 174; N. Himmelmann, 1989, 101, Abb. 39; F. Queyrel, 1990, 153f., N 422; R. Fleischer, 1991, 15-17 with complete references: "Das Werk is eine nicht erstklassige Kopie nach einen hellenistischen Original".

221 B. Barr-Sharrar, 1987, 76; F. Queyrel, 1990, 103, N 21; see complete bibliography: R. Fleischer, 1991, 102.

222 F. Queyrel, 1990, 154, N 427; see complete bibliography: R. Fleischer, 1991, 103.

223 F. Queyrel, 1990, 155, see complete bibliography: R. Fleischer, 1991, 105-106.

on a statue of Alexander the Great by Lysippos[224]. However, R. Fleischer did not include the three items mentioned above in his catalogue of Seleucid royal portraits and suggested that they have nothing to do with representations of the Seleucids, nor do several other bronzes identified with them[225].

Perhaps the greatest prosperity reached by metalworking in Antioch was attained during the reign of Antiochus IV, who himself was so interested in toreutics that he sometimes left his palace incognito and went to one of the districts of the city, where he visited the workshops of the gold- and silversmiths (Athen. V. 193D). Royal orders, especially in connection with the so-called Olympic Games of Antiochus in ca. 167 B.C., attracted numerous craftsmen in the city, thus establishing the city's name as a centre for metalworking[226].

Silver bowls with engraved floral patterns ornamented with gilding and found in the 1960s in Iran, were considered to have been manufactured in the 2nd-1st century B.C. in the workshops of Antioch; however recent analysis by M. Pfrommer has shown that the anchor-dolphin emblem on these and related bowls is more typical of Parthian table silver[227]. Even after the fall of the state the remnants of the treasuries of the Seleucids continued to arouse feelings of admiration and jealousy on the part of the Romans (Polyb., fr.154=Athen. II. 45B). Cicero mentioned gold cups, which had belonged to the children of Antiochus X and were decorated, as was usual with kings, especially in Syria, by beautiful precious stones (Verr. IV. 62). Silver medallions also exist which are decorated in relief with mythological scenes and floral patterns and which are attributed to Syrian workshops of the 1st century B.C.[228]. A rhyton from treasure II in the J. Paul Getty Museum was probably manufactured in the late 1st century B.C. in a Hellenised atelier in Mesopotamia or Syria, a workshop steeped in the decorative repertoire of the old Seleucid world[229].

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[224] C. Rolley, 1986a, 53, 166.

[225] See R. Fleischer, 1991, 31-38 (Antiochus III), 41 (Seleucus IV). He discusses these pieces in the chapter entitled "Keine Seleukiden" (R. Fleischer, 1991, 102, 103, 105-106).

[226] G. Downey, 1961, 98-99, note 58.

[227] A. Oliver, 1977, 80-81, N 44; cf. M. Pfrommer, 1993, 23-26, 56, figs. 17-19.

[228] M. Pfrommer, 1987, 138; K. Parlaska, 1991, 57-58, Anm. 53; Taf. 25b; 26a-b. "Demnach ist die Lokalisierung dieser Silberarbeiten in Syrien oder einem benachbarten seleukidischen Territorium als sicher anzusehen" (K. Parlaska, 1991, 58).

[229] M. Pfrommer, 1993, 49.

There is practically nothing known about the jewelry workshops of the Seleucid Kingdom, as B. Deppert-Lippitz assumes[230], although it is suggested that they would have existed in Antioch. However, analyses of actual archaeological finds prove that they did exist. Although a mould of the early 2nd century B.C. for casting of earrings with lynx-heads has been found in Egypt, the majority of finds come from the Syrian region, leading to conclusion that such ornaments first appeared in workshops of the Seleucid state, where they had been manufactured in the course of the 2nd and early 1st centuries B.C. (fig. 46, 1)[231]. The Syro-Seleucid form is typified by earrings bearing female heads, whose appearance has been dated back already to the late 3rd century B.C. (fig. 46, 2)[232]. The development of one of the most popular types of ornament of the Hellenistic era—earrings with erotes—is probably mainly associated with Seleucid workshops, although finds of such earrings are known elsewhere: they were comparatively rare in Italy, Greece and Asia Minor, but more popular in the North Pontic area and Southern Thrace, while the majority of finds originate from within the Seleucid state. This early type of earring was probably created in Macedonian workshops in the second quarter of the 3rd century B.C., but modifications to it were already being reproduced in Syrian ateliers in the late 3rd—early 2nd century B.C. In the first half of the 2nd century B.C. local variants appeared, which are also known from Seleucid Mesopotamia and further to the east up to the Greco-Bactrian Kingdom (the Oxus Treasury, Tillya-Tepe)[233].

A silver appliqué ornament from the arm-rest of a couch with a bust of Silenus and found in Asia Minor bears an inscription. It mentions its purchasers, Aphrodisias and Protios, and the master craftsman, Pausanius, the cost of the work, 628 drachms, and the date: the month of *Apellai*, in the year 206. It has been suggested that the date was given according to the Seleucid era, so that the couch was made in 107/6 B.C.[234].

It was probably in a workshop in Antioch, as suggested by the publisher of the find, or at Seleucia on the Tigris, as maintained

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[230] B. Deppert-Lippitz, 1985, 209.
[231] M. Pfrommer, 1990, 175-178, Abb. 33.
[232] M. Pfrommer, 1990, 180-184, Abb. 35.
[233] M. Pfrommer, 1990, 187-193, Abb. 37-39.
[234] S. Faust, 1989, 148, Kat. N 457.

by A. Invernizzi and P. Bernard, and in the last decades of the 2nd – first half of the 1st century B.C. that a bronze statuette of Heracles, 85 cm high, was cast. It is cast in the traditions of the Lysippean school; to judge by an inscription in Greek and Parthian, the figure was originally dedicated at a sanctuary of the Kingdom of Mesena near to the estuary of the Tigris and Euphrates. In 150/151 A.D. after the victory of the Parthian king Vologesos II over the local king Mithridates, the statuette was carried off to Seleucia[235]. Along with Seleucia Susa was a prominent centre for artistic metalwork in the Late Hellenistic period. This is evidenced by the bronze statues mentioned in the inscriptions which were most probably of local workmanship, but fashioned following Greek traditions[236].

## Bactria

A goldworking centre which had already been established here in the previous period was still in operation. A polychrome style, the most vivid examples of which are the so-called Siberian Collection of Peter the Great and finds from Sarmatian tumuli, most probably originated in Bactria[237].

The toreutic ateliers of the Greco-Bactrian Kingdom worked under strong influence of the Hellenized East and borrowed the general lines of the decoration of Greek bowls of the 2nd century B.C. and their traditions seem to have survived the collapse of Greco-Bactria. Their characteristic products include silver bowls and phalerae[238].

During the 2nd century B.C. the Bactrian kings Euthydemos II, Agathokles and Pantaleon issued coins made of a cupro-nickel alloy. It is worth remarking that a parallel series was struck in copper and other copper alloys. The results of analyses firmly establish that all three kings issued the same coin types, which were identical in design and weight, in both cupro-nickel and copper, or another copper alloy but that there seems to have been no attempt to distinguish the two metals in the denominations issued.

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235 W. al-Salihi, 1984; 1987; cf. A. Invernizzi, 1989; cf.: P. Bernard, 1990.

236 A. Invernizzi, 1989, 104-106.

237 See, e.g. M.I. Rostovtzeff, 1926; V.A. Sarianidi, 1989; M. Pfrommer, 1993, 58-64. See about "Siberian collection of Peter the Great": S.I. Rudenko, 1962; C. Gatsie, 1975, 207-228 with references on p. 209, note 1.

238 See, e.g., K.V. Trever, 1940, 34-38; M. Pfrommer, 1993, 5-13, 54-55, 180, N 67 with references on p. 69 ff.

It is also interesting to note that this white alloy was not used to 'stretch' the silver in the contemporary series of silver coins. Coins were not the only articles manufactured from cupro-nickel at this period. At Taxila, to the south-east of Bactria, jewelry and other small artefacts have been found which containing 9-21% of nickel[239].

Sicily

The existence of a centre of artistic metalwork here, at least in Syracuse at the court of Hieron II (265-216 B.C.), is proven by the fact that a magnificent ship, the *Syrakousia*, was constructed here and sent to Ptolemy; it was so big that it could not enter any port (Athen. V. 206D, 207C)[240]. In 212 B.C. its treasuries, primarily those comprising gold and silver and including sculptures cast from precious metals, were looted by the Romans[241].

Southern Italy

By contrast to the Archaic and Classical periods the bronze-working industry at Tarentum of the late 4th-3rd centuries B.C. is represented by a smaller range of articles whose attributions are not always undisputed. It was probably here that the sedentary figures of Ephebe and Silene[242] and fragments of a couch arm-rest appliqué with an image of Odysseus of ca. 300 B.C.[243]. were cast, although metal reliefs, which decorated mirrors and horse harness[244], were somewhat more popular.

The so-called "Lucanian panoply" with its rich decoration of reliefs and engravings was probably manufactured in Tarentine workshops[245]. The production of highly decorated armour (helmets, cuirasses, and girdles) generally flourished in the workshops of Southern Italy, in particular in Apulia in the Early Hellenistic

239 M.C. Cowell, 1989.
240 G. Grimm , 1981, 16-18.
241 B.S. Ridgway, 1990, 368.
242 P. Wuilleumier, 1968, 318-319.
243 P. Wuilleumier, 1968, 328-329.
244 W. Züchner, 1942, 102, BR 5 (with references); B. Segall, 1965, P. Wuilleumier, 1968, 322-324; A. Adriani, 1969, 69 ff.; M. Borda, 1984, 714-715; E.M. de Jullis, 1989, 46.
245 A. Bottini, 1989, 710, note 26; *Armi in Lucania*, 1993, 159-176 (P.G.Guzzo); 177-179 (H.-M. von Kaenel).

period. This is probably connected with the active recruitment of mercenary troops here[246].

Various bronze situlae with sculptured handle attachments were produced by Tarentine or Capuan workshops[247], although recently there has been a tendency to see some of these as having been manufactured in workshops in Macedonia or Thrace[248]. Pliny mentioned Tarentum as a centre for the production of candelabra (N.H.XXXIV. 3. 11).

Bronze caskets with relief representations of erotes found in the sanctuary of Artemis Hemera at Lusoi in Arcadia may well have been manufactured in early Hellenistic workshops in Southern Italy[249].

At the same time, Tarentum was in the Hellenistic period one of the main toreutic centres: Livy (XXVII. 17. 7) reported the enormous treasuries, in the main of all kinds of metal utensils, captured by the Romans during the sack of the city[250].

It was perhaps in the second quarter of the 3rd century B.C. that the production began of relief Calenian ware which imitated expensive silver vessels: it has been suggested that the works of Tarentine toreuts served as prototypes for at least some of the medallions[251].

On the basis of the fact that finds of jewelry of the 4th-3rd centuries B.C. are concentrated in Southern Italy, P.G. Guzzo maintains that they were manufactured locally in workshops in Cumae, Tarentum and Teanum[252].

Finds of a specific type of gold earrings with lion heads are concentrated in Southern Italy, primarily in Tarentum, and these were produced by workshops of the 3rd century B.C. in Magna Graecia[253].

It has also been suggested that spiral pendants with protomes at their ends[254] were of Tarentine manufacture as were basket-like

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[246] P.G. Guzzo, 1990, 8-10.

[247] G. Zahlhaas, 1971.

[248] M. Pfrommer, 1983, 250-263; C. Rolley, 1987b; 1990b, 371-372; cf. B. Shefton, 1985.

[249] V. Mitsopoulos-Leon, 1990.

[250] C. Rolley, 1986a, 192.

[251] B. Barr-Sharrar, 1987, 132. See in general on South Italian relief medallions: R. Pagenstecher, 1909; M.-O. Jentel, 1976. On the interdependence of Hellenistic relief potery and toreutics see, e.g.: W. Züchner, 1951, 175-205; J. Salomonson, 1982, 164-173.

[252] P.G. Guzzo, 1993, 133.

[253] M. Pfrommer, 1990, 154-157, Abb. 26.

[254] P.G. Guzzo, 1993, 89, 133, cat. IIIA on pp. 248-249.

earrings with pendants shaped like amphoras, palmettes and abbreviated mulberries[255].

In the last quarter of the 3rd century B.C. new types of ornaments were created in the jewelry workshops of Tarentum, whose decorative features combined gold and precious stones, the motif of the "Heraclean knot" in chains and diadems, bracelets whose ends were shaped like snake heads etc. This took place just before the sack of the city by the Romans in 209 B.C.[256].

A group of gold rings with large circular bezels, dated to the second half of the 4th century B.C. and found primarily in Cumae, is held to be of local manufacture[257]. At the same time a homogenous group of silver finger rings with elliptical bezels of medium size originates from Teanum, where it was probably produced[258].

## Thrace

Analysis of gold earrings decorated with lion-heads found in modern Bulgaria allows us to distinguish two variants, one of which was common from the late 4th to the middle of the 3rd century B.C., whilst the second was widespread in the 2nd century B.C. There is reason to suppose that earrings of the first type were manufactured in workshops in the Greek cities on the Black Sea coast and on the northern coast of the Aegean Sea; at the same time workshops probably existed in Thrace proper: in north-eastern Bulgaria and around Seutopolis, where imitations of imported articles were created. Earrings of the second type are found mainly in north-eastern Bulgaria: their closest comparanda are found among objects from the Northern and North-Western Pontic area[259]. This tendency was generally characteristic of jewelry art in Thrace in the Hellenistic period[260].

The workshops of Thrace in the Early Hellenistic period produced original toreutic works, for instance a series of rhyta

[255] P.G. Guzzo, 1993, 90-92, 133, cat. IVA on pp. 249-251.
[256] E. Formigli, W.-D. Heilmeyer, 1990, 82-85; W.-D. Heilmeyer, 1990.
[257] P.G. Guzzo, 1993, 30, 133, cat. IIA on pp. 163-164.
[258] P.G. Guzzo, 1993, 37-38, 133, cat. VA on pp. 169-170.
[259] M. Dimitrova, 1989.
[260] *ArhaeologiaSof* 2 (1989), 68-69. See also about Thracian Hellenistic fibulas: R.A. Higgins, 1982, 144.

shaped like animal heads with reliefs depicting mythological scenes[261].

The Northern Pontic area

In the Scythian tumulus of Kul'-Oba and in tumuli excavated near to the village of Velikaya Belozerka swords were found in scabbards with gold overlays which dated to the last third of the 4th century B.C. The compositions on the right sides partly coincide with the inscriptions on each of the overlays: **ΠΟΡΠΑΧΟ** and **ΙΠΟΡΙ**. The absence of any wooden or bronze matrix under the overlay of the scabbard found in Velikaya Belozerka proves that several overlays may have been struck from a single matrix. It is thought that they were manufactured in Bosporus[262].

Already in the early 3rd century B.C. necklaces were appearing in the Northern Pontic area with clasps in the shape of lions' heads[263]. The Northern Pontic region may have been one of the centres in which wreaths with "Heraclean knots" were manufactured; they appeared here in the first half of the 3rd century B.C.[264]. One more group of articles which were probably made in Northern Pontic workshops belongs to the second quarter of the same century: they are figural pendants, which decorate diadems with "Heraclean knots"[265]. In the late 3rd-early 2nd centuries B.C. Bosporan workshops manufactured provincial variants of diadems with "Heraclean knots" which were decorated with insets of coloured stones, like the find from the Artyukhov tumulus; this tradition was interrupted in the middle of the 2nd century B.C.[266]. It should not be ruled out that it was in Northern Pontic, perhaps Olbian, ateliers that necklaces were manufactured with insets of coloured stones and butterfly-pendants, which were still in use in this region in the 1st century A.D. However, as N.V. Pyatysheva has suggested, these ornaments from the first centuries A.D. may have

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[261] See, e.g. I. Marazov, 1978; H. Luschey, 1983; P. Zazoff, C.Hocker, L. Schneider, 1985, 599 ff. P. Zazoff, C. Hocker and L.Schneider have also maintained that the vessels from Panagyurishte were manufactured in a Thracian workshop (see above on p. 303 f.).

[262] See the sword from Kul'-Oba, e.g.: M.I. Artamonow, 1970, Abb. 208-209; the sword from Velikaya Belozerka: V.V.Otroshchenko, 1987, 126.

[263] M. Pfrommer, 1990, 84.

[264] M. Pfrommer, 1990, 43-44, Abb. 9.

[265] M. Pfrommer, 1990, 53-54.

[266] R.A. Higgins, 1980, 158; 1982, 146-147; M. Pfrommer, 1990, 72-73.

been made by jewellers, who had been resettled in the 1st century B.C. by the Armenian kings Tigranus II and Artavazdes II from the Hellenistic cities of Asia Minor and Syria to Armenian cities[267]. The gold medallions from Armavir may have been of Armenian manufacture; their iconography and style show the influence of Seleucid art[268]. It was probably in the 2nd century B.C. that Bosporan bronzeworkshops created a local variant of buckle composed of two rings with a horizontal clasp and imitating the shape of Sarmatian buckles of the 3rd-2nd century B.C. Bosporan craftsmen added an inset, decorated with a relief mask, to the central part: rare finds from this series have been made in the Artyukhov tumulus (silver), the Kuban basin, and at the necropolis of Scythian Neapolis. In Pantikapaion a variant was found without a mask[269].

### *4.2.3. Metalworking in the Hellenistic Era*

#### *4.2.3.1. General Characteristics*

It is thought that in the Hellenistic period workshops were usually small. According to F.W. Walbank, who relies on the picturesque story of how Antiochus IV visited the toreutic workshops at Antioch, the character and organisation of production was unchanged in relation to the previous period; there are no signs of "mass manufacture"—the typical workshop was small, a master worked there with one or two slaves, and production was on a domestic level[270]. However, this is true only for a number of small workshops, including toreutic ones.

What was the position of industry in the economy of the Hellenistic city? One is given an idea by the example of 1st-century B.C. Delos. A. Papageorgiou-Venetas estimates the total size of the Delian population at 28000, of whom 6000 were economically active, while 5000 of these were freemen and were 1000 slaves. Half of the economically active population was engaged in trade, and

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267 M.V. Skrzhins'ka, 1990, 39-40; N.V. Pyatysheva, 1956, 36-37, 79-80; cf. M.Yu. Treister, 1993b.

268 G.A. Tiratsyan, 1978, 144-145.

269 See: M.Yu. Treister, 1992a, 106-107, notes 163, 178.

270 V. Ehrenberg, 1974, 87; F.W. Walbank, 1981, 162-163; see also: C. Vial, 1984, 354.

only 12% or 700, including 300 slaves, working in a total of 220 workshops worked at crafts. Workshops were concentrated in the trading centre of the city and in the trade port. There was no centre for craft industry in the true sense: the rare known examples of workshops were situated in dwelling houses or were attached to shops, so that it is not possible to claim that Delos was a centre of the art industry. Of 40 ateliers and shops located on the 320-metre-long main street only one was a metal workshop (compared with 2 painters' shops, 4 ceramic workshops, 8 workshops for marble carving and sculpture, and 15 businesses trading in grain and wine)[271].

In spite of the modest position occupied by crafts in the economy of Delos in the Hellenistic period, an important role was played by a local school of metalworking which specialized in the production of metal utensils and furniture decoration, or at least to judge by the evidence provided by ancient writers, archaeology and stylistic analyses of objects; it is thus not mere chance that Delos is sometimes called "an island of bronzes"[272]. This particular Delian specialization was promoted by the conversion of the island into a haven for free trade, a city of wealthy merchants from many parts of the Mediterranean[273].

The existing evidence for the leasing of workshops shows the following changes in prices. A smithy in the house of Orphokles was rented in 279 B.C. for 41 drachms and in 207 B.C. for 95, while in 179 B.C. it went for 109 drachms. These prices are lower than those of ceramic workshops or shops[274]. Persons, who rented workshops were probably well-to-do; often they filled various magistracies. For instance, Phokion, who leased a smithy, was a treasurer in 184 B.C. and a *hierope* in 172 B.C.[275].

Could there have been a metalworkers' quarter outside the city walls at Delos, like those already known from the previous period?

Memphis offers another example of metalworking within in a city context. Judging by literary testimonia and finds of limestone models for helmets, as well as of plaster casts for decorative shield bosses, sword grips and helmet reliefs, the city was a centre for the armaments industry. It has been claimed that the supply of arms

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[271] A. Papageorgiou-Venetas, 1981, 115-119. See about city plan of Delos also: W. Hoepfner, E.-L.Schwandner, 1994, 293-298.

[272] C. Rolley, 1986a, 193.

[273] O.B. Lopukhova, 1990.

[274] C. Vial, 1984, 355.

[275] C. Vial, 1984, 353-354.

in preparation for the Fourth Syrian War (219-217 B.C.) was organized from the city. Besides the regular needs of army, the ceremonial life of the Ptolemaic court and festivals could require the use of military dress even outside Alexandria. Apart from supplying the army, workers in bronze produced numbers of bronze statuettes. Such bronzeworkers worked alongside the blacksmiths, silversmiths, and goldsmiths of the city in producing household objects in everyday and luxury models. It has been suggested that a series of contiguous workshops were located in what was probably the metalworkers' district of the city at Kom el Nawa and Kom el Arba'in, close to the temple of Ptah, their patron deity. The blacksmiths probably had their own quarter. Temples were production centres with their own workshops, storehouses and indirectly, they played an economic role, making the city a magnet for priests, pilgrims and tourists[276].

Alongside the small workshops were large ergasteria, such as arms workshops or shipyards. Hieron II, king of Syracuse, built a ship to carry grain. Athenaeus (V.206D) reports: "Since there were 300 craftsmen, exclusive of assistants, working on the materials, half of the ship was finished in six months, down to the sheathing of each area, as it was completed, with lead sheets"[277]. To give an impression of how much metal was required for the building of such ships let me call to mind the weight of the ram found near Athlit (465 kg), which did belong to one of the largest Hellenistic warships (see above). There was an enormous requirement of iron for arms and anchor shanks and of lead for anchor stocks[278].

In principle the distribution of metal articles in the Hellenistic period reveals a tendency for growth in the manufacture of vessels, especially those made of precious metals, and of utensils, for example, of pieces of metal appliqué for couches, candelabra etc.; the main cause of this was the needs of royal courts and of trading classes[279]. The manufacture of silver ware increased in importance: from the 3rd century B.C. bronze vessels became less interesting, gradually losing their artistic value and changed from being luxury objects, prestige articles, to being "middle class" utensils[280].

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276 D.J. Thompson, 1988, 65-67, 81.
277 L. Casson, 1994, 121-122.
278 L. Casson, 1994, 119.
279 C. Rolley, 1986a, 190, 192.
280 C. Rolley, 1986a, 192-193.

The heyday of the manufacture of bronze statuary was in the 3rd to the first half of the 2nd century B.C. From the mid-2nd century B.C. marble was used often instead of bronze as a material for statues[281].

In the Hellenistic period public dedications of statues and sculptural groups were gradually replaced by the dedications of private persons, while portraits and decorative sculpture in parks and palaces was common[282]. There is a remarkable set of statistics concerning the installation of victors' statues at Olympia: these were common in the Classical period, but underwent a sharp reduction from the mid-2nd century B.C., although these statistics, based on the evidence provided by Pausanius, differ from those given by the surviving bases of sculptures[283]. This process brought about a change in the techniques for casting bronze statuary (see below)[284]. Bronze statuettes, which had been practically unknown in the previous 150 years, acquired a new significance in the Hellenistic period and took on the function of decoration for the houses of the rich; the average size of the figures usually grew, and they so came to occupy an intermediate position between true statuettes and bronze sculptures. Bronze statuettes were, as a rule, reproductions of well-known full-size statues which had been cast in prominent sculptural ateliers. The traditions of Polyclitus, Lysippos and other famous artists of the 5th-4th century B.C. are traceable in Late Hellenistic small plastics. The proportions and modelling of late 2nd-1st century B.C. figures are closer to the artistic standards of the era than to those of their prototypes. Among the Hellenistic bronze statuettes one can distinguish genre figures and the portrait images of rulers, whose appearance was partly associated with a change in the function of bronze statuettes: a transition from votive to decorative use[285]. Small bronze plastics of the Hellenistic and Early Imperial periods raise many questions about the organisation of "reproduction workshops". It is plain that the imitation of bronze statues in miniature had already developed in the Classical era. Archaeological evidence and narrative sources give no basis for a reconstruction of

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281 G. Lippold, 1950, 365.
282 B. Barr-Sharrar, 1990, 218.
283 H.-V.Herrmann, 1988, 123-131.
284 C.C. Mattusch, 1990a.
285 J. Bazant, 1979; R. Thomas, 1992, 32-34, 120-121.

the creative processes within such workshops of the Hellenistic period. Many questions cannot at present be solved. What for instance was the relation between the artistic concept of the bronze statuettes and customer taste? What role was played by a customer's cultural sophistication in the process of copying? Were copies bought to acquire a reproduction of the much admired work of a famous artist? Small bronze plastics need not have been produced only in the workshops of craftsmen, who specialised in reproductions. For example, Martial (IX. 43. 44) and Statius (Silvae 4.6) mention a statuette of Heracles fashioned by Lysippos, although no single bronze figure has yet been identified with certainty as the work of this famous sculptor[286].

At the same time, the votive function of such figures, which was characteristic of the Archaic period, was still to a certain extent preserved in the Hellenistic period. This is shown, for instance, by a bronze figure of a strategist dated to the early 3rd century B.C., which probably originated in Dodona, the sanctuary of the Epirotes[287].

The specialisation of various centres in different fields of metalworking was more typical of the Hellenistic period than of the previous one. This may however have been for different reasons. For example, with the growth of Roman strongpoints in the Mediterranean the workshops of Greece in the second half of the 2nd-1st centuries B.C. produced very large numbers of bronze utensils and sculptures for Roman clients, among whom Greek tastes and customs became fashionable[288]. C. Rolley suggests that there are no examples of bronze plastics which can be dated to between 200 and 160 B.C.[289]. However, this is probably explained by the fragmentary nature of the evidence and by arguable datings (cf. the views expressed by B.S. Ridgway about the dating of the Baker dancer to 225-175 B.C.; see above on p. 312).

### *4.2.3.2. Specialization of Crafts, and the Copying and Reproduction of Originals*

There was surely some division of labour between sculptors and founders in the 3rd century B.C. That this was so is shown by in-

286 A. Leibundgut, 1990, 423; cf. R. Thomas, 1992, 121, Abb. 116.
287 C. Rolley, 1986a, 200, N 293.
288 C. Rolley, 1986a, 193; B. Barr-Sharrar, 1990, 216 ff.
289 C. Rolley, 1986a, 198.

scriptions on the bases of statues from Rhodes[290]. These sculptures were thus cast in Rhodes by craftsmen from Ephesus and Kos[291]. A single sculpture was sometimes created by masters from various centres: for example, Chios and Ephesus, Rhodes and Kos, Antioch and Rhodes etc.[292], which were usually not too distant from each other.

Analysis of sculptural fragments from the Antikythera shipwreck suggests to P.C. Bol that, as in the Classical period, the creation of sculptural groups involved not the collaboration of distinct masters, but the division between existing bronzeworkshops of all the work from the creation of a wax model to the installation of the statue[293]. Further developments of the technology for casting bronze sculptures led to the construction of modernized casting pits tiled on the inside. For instance, two similar casting pits at the workshop of Eubulos in Rhodes had evidently been constructed by a professional mason[294].

This growth in specialization led to a tendency which developed later on in the Roman Empire[295]. Craftsmen in various professions were already forming professional guilds in the Hellenistic epoch.

In Argos in the early 1st century B.C. there existed an association of smiths. This association owned a temple dedicated to Hephaistos[296]. Another example that I would mention is an inscription of 47 B.C. from Sidon, which mentions a guild of armourers, specialized in manufacture of swords[297]. This was probably connected with the evolution of an consciousness of identity among Hellenistic craftsmen. Images of armourers making helmets, shields or articles of bronze were as common in the 2nd-1st centuries B.C. and later on in the Imperial period[298] as were scenes of workshops on vases of the 6th-5th centuries B.C. Depictions of metalworkshops are known from reliefs on Hellenistic vessels, for instance, on the so-called Homeric bowls[299].

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290 C. Blinkenberg, 1941, N 84, 119.
291 G. Zimmer, 1985, 47-48; M.Yu. Treister, 1988, 156-157, note 27.
292 M.Yu. Treister, 1988, 156.
293 P.C. Bol, 1985, 168-169.
294 G. Zimmer, 1990, 118-119.
295 S. Mrozek, 1989, 55.
296 P. Charneux, 1992, 339, note 27.
297 See: H. Wilsdorf, 1952, 170.
298 See: C.C. Mattusch, 1975, 79-80.
299 U. Sinn, 1979, 102-104, Abb. 8.

The increase in the serial production of metal articles in the Hellenistic period and, correspondingly, the further division of labour within workshops are shown by the casting of separate details of bronze statuettes—arms, legs, drapery—which may have then been attached to the figures of various deities. This technique, which was especially wide-spread in the Roman Empire, was originally used in the Late Hellenistic period in the most advanced art centres: in Southern Italy and Ptolemaic Egypt[300]. D. Kent Hill, who is evidently modernizing the degree of division of labour and the volume of production, held that there was a factory system for producing small bronzes[301]. It is difficult to date the appearance of this system with any great precision; however the Antikythera shipwreck does give a *terminus ante quem*. The figures of Dionysus from the museums of Baltimore and Cairo and former Fouquet collection can be dated to the Late Hellenistic period. Less certain datings can be made more precise by using bronze rings. Among these rings, which probably cast in Ptolemaic Egypt in the 3rd century B.C., are a number of pieces with bezel insets also cast in bronze but which have various engravings. These show that there had been some division of labour in the process of manufacturing a single piece and that production had a serial character[302].

In the Hellenistic epoch there was a common method for the exact copying of large-scale bronze sculpture by means of plaster casts, which had been probably used earlier by sculptors such as Kanachos and Myron (see above on p. 232). If we accept Pliny's view (N.H. XXXIV. 153) that the discoverer was a brother of Lysippos, the sculptor Lysistrates, he, therefore, may be seen as the originator of the indirect casting process. The advantage of this technique is due to the fact that wax models cast in moulds, made from an author's model or direct from a living person, needed no further treatment by a craftsmen; thus, a founder could cast a wax model first and then a sculpture, resulting a considerable saving of metal because of the reduced thickness of the bronze casting. If the sculpture were miscast the founder need not address himself once more to the sculptor. The technique of exact reproduction by indirect casting, which developed in the Hellenistic

[300] D. Kent Hill, 1958; 1969, 74; 1982.
[301] D. Kent Hill, 1982, 279.
[302] M.Yu. Treister, 1982, 73, note 54.

period, was directly associated with the growing popularity of reproductions of Greek originals. C.C. Mattusch thinks that by the late 2nd century B.C., when the so-called head of a Roman, found in Delos, was cast, the technique was already fairly common[303].

This technique, which was widely used for making large-scale bronze sculptures, was also generally adopted in toreutics, to judge by the finds of plaster casts in various parts of the Greek oikumene. Although one can dispute (see above on p. 315) a hypothesis put forward by C. Reinsberg that a workshop existed at Memphis in the third quarter of the 4th century B.C.[304], Pliny's reference to the 1st-century B.C. sculptor Arkesilaos, a friend of Lucius Lucullus, who made clay models to sell them to other craftsmen and fashioned a plaster model of a krater for a talent for a Roman knight (Plin.N.H. XXXV. 155-156)[305] show that this technique was in use in at least the 1st century B.C.

By the end of the Hellenistic epoch the division of labour in bronzecasting had reached a level, which can best be described in the words of Horace, who offered his commiserations to a disappointed master who was able to cast only the nails and curls for a statue, but not a sculpture as a whole (De arte poetica 32 ff.)[306].

At the same time universal craftsmen probably did exist. It is true, perhaps, of Lysippos, who, according to Pliny (N.H. XXXIV. 61), was first an ordinary founder[307]. One can also cite the biography of Euandros. He was famous in Athens in ca. 50 B.C. as bronzefounder, toreut and the creator of marble sculptures. His works were acquired by Cicero. Antony invited Euandros to Alexandria from where in 30 B.C. he went to Rome as a captive. Once in Rome he made at the request of Augustus a new head for the statue of Artemis created by Timopheus, which was installed in the temple of Apollo on the Palatine[308].

#### *4.2.3.3. Migrations of Craftsmen*

As a result of the grandiose plans of Alexander and the diadoches, city building programmes reached enormous scales in the

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303 C.C. Mattusch, 1975, 52-56; 1990a.
304 C. Reinsberg, 1980, 270.
305 C.C. Mattusch, 1975, 57-58.
306 D. Kent Hill, 1969, 66.
307 J.J. Politt, 1987, 47.
308 G. Lippold, 1950, 381.

Early Hellenistic era[309], especially in the East. At the same time old cities underwent reconstruction, as did Priene in the late 4th century B.C. A broad programme of building at Delos which began in the late 4th century B.C. and continued into the first half of the following century, attracted mainly itinerant craftsmen, who left Delos after they had finished their work[310]. For the restoration of the Colossus of Rhodes Ptolemy III pledged to supply Rhodes not only with 3000 talents (probably, of bronze)[311], but to send 100 architects and 350 workers as well as 14 talents annually for their pay (Polyb. V. 89). A considerable number of these workers were probably metalworkers, who had earlier been employed in the royal ergasteries of the Ptolemies. In the same reign Hippomedonos and Epinikes received catapults and missiles from Ptolemy III. E.W. Marsden has suggested that either the catapults were sent directly from Alexandrian workshops, or craftsmen were dispatched to make these engines on the spot[312].

B.S. Ridgway holds that in the 3rd century B.C. artistic activity was focussed on the foundation of new cities and, thus, on the construction of public buildings rather than on creating sculptures (this was the principal difference with the situation in Athens after 450 B.C., where building programmes were supplemented by large-scale sculptural projects in conjunction with temple construction). Part of the architectural decoration of public buildings of the 3rd century B.C. was made of bronze (e.g. the Pharos lighthouse). Most of the monuments erected to celebrate victories and honorific sculptures were also cast in bronze, as an expression of dynastic propaganda[313]. For instance, we have in the case of forty of the Hellenistic and Augustan statues on Kos evidence or information about the material used: 17 are of marble and 21 are bronze statues, while in one case gilt bronze was used. It is also worth noting the distribution of marble and bronze statues according type. For example, ten of the marble statues have a

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309 J.-H. Schalles, 1985; B.S. Ridgway, 1990, 6; J.D. Grainger, 1990, 127-138; 1990a, 48-87; H.S. Lund, 1992, 174-177; W. Hoepfner, E.-L. Schwandner, 1994, 235 ff. So, it is estimated that the number of new inhabitants moving into four large cities established by Seleucus I approaches half a million (J.D. Grainger, 1990a, 100).

310 P. McKechnie, 1989, 54-61, 146.

311 See: M.M. Austin, 1981, 164.

312 E.W. Marsden, 1969, 76-77.

313 K. Tuchelt, 1979, 68-90; B.S. Ridgway, 1990, 373.

dedicatory character and seven of these depict gods or what may be presumed to be gods. Twelve of the bronze statues are honorific and seven are both honorific and dedicatory[314].

At the same time the decline of production and demand in the old centres of the Greek world, which led to mass unemployment and pauperism were the reasons of considerable immigration of the craftsmen in the epoch after the decay of Alexander the Great's Empire. Narrative sources testify to the significant level of emigration from Greece, Macedonia and Asia Minor to Egypt; outsiders entered into military service in Ptolemaic Egypt. Thus, of 158 mercenaries, mentioned in a document dated to ca. 200 B.C., 48 originated from Macedonia, 26 from Central and Northern Greece, 17 came from Asia Minor and the Aegean Islands and 49 from the western regions of the Greek world [315]. In C. Rolley's striking image[316], the capitals which developed around the royal palaces attracted growing numbers of new settlers—officials, officers, and traders—who could be called "a new bourgeoisie", and these were accompanied by artists and intellectuals.

An example of the migration of artists in the Early Hellenistic period is the fate of one of the most prominent sculptors, Lysippos, who usually worked in bronze. Born in Sicyon, he worked mainly in Macedonia, although his statues were installed in Delphi, Olympia, and Athens and even Tarentum. According to Pliny (N.H. XXIV. 37), Lysippos created 1500 bronze statues during his career, although this number seems highly exaggerated[317]. The cost of one bronze statue was about 3000 drachms[318], at least this was the price of a bronze equestrian statue in the 4th century B.C., according to Diogenes (Diog.Laert. VI. 2. 35)[319].

The study of the bases of Hellenistic and Augustan statues from Kos has shown that of 91 bases with inscriptions, only seven bear the signature of the sculptor and none of these inscriptions can

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[314] K. Höghammar, 1993, 68f.

[315] G.T. Griffith, 1935, 241; V. Ehrenberg, 1974, 83; D. Hennig, 1989; S. Mrozek, 1989, 57.

[316] C. Rolley, 1986a, 187; see also: V. Ehrenberg, 1974, 84-85.

[317] P.C. Bol, 1985, 165; J.J. Politt, 1987, 50; P. Moreno, 1988; B.S. Ridgway, 1990, 73-74.

[318] P.C. Bol, 1985, 164. Cf. with the cost of a bronze statuette which is suggested by R. Thomas to be 150-250 drachms, quite comparable with that of a marble statue. See: R. Thomas, 1992, 35-36.

[319] E. Maul-Mandelartz, 1990, 150, Anm. 622.

with certainty be said to refer to a Koan sculptor. The sculptors working on Kos thus originated from Alexandria, Cyrene, Paros, Iasos and Kalymnos. K. Höghammar maintains that it seems fairly certain that Koan sculptors did not sign their works[320]. If one accepts this idea, then the proportion of non-resident sculptors on Kos was less than 10%.

M. Pfrommer, in analyzing a corpus of Macedonian gold ornaments of the Early Hellenistic period, has come to the conclusion that it resulted from the creative reworking of various influences, elements which were probably not borrowed directly by Macedonian craftsmen, but were introduced by wandering artists attracted to the Macedonian court[321]. Similarly, in discussing the distribution of one of the variants of "Heraclean knot" in Northern Pontic area in the late 4th-early 3rd century B.C., Pfrommer has argued that a jeweller acquainted with the artistic motifs of Magna Graecia was working here[322].

The disintegration of the Persian Kingdom after its conquest by Alexander led to the mass unemployment of numerous craftsmen, toreuts, jewellers etc. There is some reason to believe that some of these migrated to Ptolemaic Egypt[323]. In this context we should remember an Early Hellenistic bronze matrix, which combines Egyptian and Achaemenid motifs[324]. At the same time, it is possible to imagine that oriental metalworkers were at work in Greek cities; this is proved by a bilingual Greco-Phoenician inscription of a metalworker dated to the late 4th century B.C. and found on Kos[325].

B. Segall has suggested that the silversmiths of Early Hellenistic Alexandria must have been of diverse origins: many of them were Ionians, who had previously worked for rich clients in Southern Russia and Asia Minor; others were of Southern Italian origin[326]. Let us consider the view of E. Langlotz concerning the plaster casts from Memphis. He suggested that already after the first heavy defeat of Tarentum by the Romans in 272 B.C. the best Tarentine toreuts went to Alexandria. Although no silver work of

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[320] K. Höghammar, 1993, 104-105.
[321] M. Pfrommer, 1990, 5.
[322] M. Pfrommer, 1990, 28-29, Abb. 7.
[323] K. Parlaska, 1979.
[324] M.Yu. Treister, in print-2.
[325] X. Kantzia, 1980; M. Sznycer, 1980; S. Morris, 1992, 133, note 134.
[326] B. Segall, 1965, 586-588.

the same quality is preserved there, the models of the toreuts, which are known from plaster casts, point to the dependence of the new world capital at Alexandria on Tarentum[327].

Analysis of a horse nose-piece with an embossed relief scene of a Gigantomachy, the *prometopidia* from a Sarmatian burial at Fedulovo[328], suggests to me that from the point of its shape it goes back to a Southern Italian prototype (both the finds of an oval nose-plaque and the moulds and plaster casts of such articles originate primarily either from Magna Graecia or from Mit-Rahinet[329]. Given the close contacts between the toreutic schools of Southern Italy and Ptolemaic Egypt and the possibility that Tarentine toreuts migrated to Egypt, why should one rule out that they travelled to the Kingdom of Bosporus, one of the most prosperous of the Early Hellenistic kingdoms. They could have travelled directly (the gravestone of a Syracusan was found in the necropolis of Pantikapaion[330]), or via Egypt, which maintained at this time diplomatic relations with Bosporus[331]: its port was visited by the ship of the Egyptian ambassador in ca. 270 B.C.[332]. It is quite possible that the prototype of the Fedulovo *prometopidia* was brought to Bosporus with such an embassy. One could properly assume that the ship of the Ptolemaic ambassador carried a lot of gifts for the court of the Bosporan ruler, and these would certainly have included toreutic works.

In connection with the question of whether articles are more likely to have been Alexandrian imports or local Bosporan imitations of imported articles of Alexandrian toreutics, the following observations made by B. Segall and later by M. Pfrommer may be cited. B. Segall considered the phalerae found in the horse burial of the second tomb of the tumulus on Mt. Vassyurinskaya to be similar to medallions of the Tarentine group and suggested that they were either imported from Alexandria or were copied from

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327 E. Langlotz 1963, 92; see also A. Adriani 1969, 87-88; M. Pfrommer, 1987, 21-22; 132-136; 160-167; E. Ghisellini, 1993. However, let us also take into account the view about Macedonian influence on the Ptolemaic toreutics; see: C. Reinsberg, 1980, 244 ff.; G. Gagsteiger, 1993, 26-27.

328 See, e.g. I.P. Zasetskaya, 1966, 31-32, fig. 5.

329 See: M.Yu. Treister, in print-4.

330 See in general about the contacts of South Italy and Bosporus in the 5th-4th centuries B.C.: M.Yu. Treister, 1993, 378-381.

331 See, e.g. M.Yu. Treister, 1985; M. Pfrommer, 1993b, 16.

332 See: N. Grach 1984, 81-88; N. Grač, 1987, 87-95; *Aus den Schatzkammern Eurasiens*, 1993, N 85.

an Alexandrian prototype[333]. M.I. Rostovtzeff dated the horse burials in the second tomb on Vassyurinskaya to the second half of the 3rd century B.C.[334], M. Pfrommer dates them to not later than the mid-3rd century B.C.[335]. He maintains that the acanthus pattern closely resembles those on the gold larnax from the "tomb of Philip" at Vergina, the palmettes belong to the North Greek—Northern Asia Minor type of "eye" palmette , whereas the floral pattern may be compared with a plaster cast from Mit-Rahinet[336]. Another example of a close similarity between toreutic works found in Southern Russia with those of Ptolemaic Alexandria is the silver phiale from Marynskaya Gora[337], which has a characteristically Early Alexandrian composition, however this type of the palmette was hitherto known only from Northern Greece and the Pontic area. The association of this archaeological evidence with the other mentioned above, which shows that political relations were established between the Lagids and the Spartokids, explains the penetration of both Southern Italian and Alexandrian motifs into the toreutics of the Kingdom of Bosporus.

It thus seems possible to suggest that for a certain period of time after the setting up of direct diplomatic contacts between Ptolemaic Egypt and the Kingdom of Bosporus, local Bosporan craftsmen—either inspired by works of art brought from Alexandria or directly instructed by Ptolemaic (and originally Southern Italian ?) craftsmen—produced in the course of approximately three-quarters of a century a series of horse-trappings decorated with embossed silver and silver-gilt plaques, often bearing compositions from the *gigantomachia*[338]. The prometopidia from Fedulovo would seem rather to be the work of a local toreut, given the quality of execution. The existence of a toreutic work-

[333] B. Segall, 1965, 563, Anm. 13.

[334] M.I. Rostovtzeff, 1931, 331.

[335] M. Pfrommer, 1987, 184, FK 62 (with references).

[336] M. Pfrommer, 1987, 101, 184, Anm. 1378.

[337] M. Pfrommer, 1987, 101, 261, KBk 106, Taf. 59a.

[338] Scythian horse nose-pieces of the 4th century B.C. had quite different shape (Tsimbalka: the flat plaque, widening in the middle and towards the ends with a palmette on one of the ends and an embossed figure of the Scythian goddess, Solokha: the plaque in shape of two fishes, see: M.I. Artamonow 1970, Abb. 146, 186-187; L.N. Galanina, N.L. Grach, 1986, pls. 144, 147; mentioned by M. Pfrommer, 1993a, 342, Anm. 20). Quite different are nose pieces found in the burials of the Late Hellenistic epoch in South Russia, the mould for casting of which originates from Scythian Neapolis (see: A.V. Simonenko, 1982).

shop, most probably associated with the royal palace at Pantikapaion at least in the 2nd century B.C., is proved by the find of a stone matrix for producing embossed gold foil plaques for the decoration of a calathus[339]. From around the 270s to 200 B.C. such horse-trappings were given both to noble Bosporans and to Scythian or Sarmatian noblemen (the finds from Bol'shaya Bliznitsa, Vassyurinskaya, Alexandropol', and Fedulovo). This fashion does not seem to have continued into the 2nd century B.C., when quite different types of phalerae[340] and nose-pieces[341] became common in the Northern Pontic area.

From this same artistic group of toreutic works are the two round bronze phalerae from Bol'shaya Bliznitsa with relief embossed plaques representing the struggle of two naked Greek warriors with a mounted Amazon[342] and a single Greek warrior with two Amazons[343]. It seems quite possible to interpret the reliefs of the phalerae from Bol'shaya Bliznitsa as local imitations of works of the Tarentine, or at least of the Southern Italian, school. Besides, it seems natural to assume that the reliefs of both the *prometopidia* and the phalerae were executed in one and the same workshop.

However, Southern Italian (Tarentine ?) motifs continued to influence local Northern Pontic toreutics. A very interesting example is a solid cast bronze buckle with the relief image of a drunken silene with a kantharos lying on a wine skin. It was found during excavations of the sanctuary at the Gurzuf Pass in the Crimean mountains[344] and is most probably to be dated to the late Hellenistic period. The prototypes of this motif, chosen for the decoration of the buckle (silenes, or negro boys, sleeping on wine skins or amphoras) were used for relief terracotta vessels, which were either characteristic, as is suggested by A. Adriani, of the Tarentine school of coroplastics in the 3rd century B.C.[345], or more probably of Alexandrian production in the same period[346]. A similar vessel, representing a drinking silene, was acquired in

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339 See: M.Yu. Treister, 1990.

340 See: e.g. M. Pfrommer, 1993, 5 ff.

341 A.V. Simonenko, 1982.

342 M.I. Artamonow, 1970, Abb. 298; L.N. Galanina, N.L. Grach, 1986, pl. 200.

343 See: L.N. Galanina, N.L. Grach, 1986, pl. 201; *Aus den Schatzkammern Eurasiens*, 1993, N 81.

344 See about excavations: N. Novičenkova, V. Novičenkov, 1991, 165-169.

345 See: A. Adriani, 1969, 81, tav. IX, 1.

346 U. Hausmann, 1962, 255-281.

1962 by the Martin von Wagner-Museum in Würzburg. However, the silene on the vessel from Würzburg, which is said to originate from Asia Minor, is shown drinking[347]; the figure on the buckle from Gurzuf Pass has already got drunk and is asleep on a wine-skin. The prototypes of such Hellenistic figured vessels in the shape of a drunk silene should perhaps be sought in Apulian figured vessels of the 4th century B.C.[348]. The construction of the buckle from Gurzuf Pass goes back to Sarmatian buckles with side hooks of the 3rd-1st century B.C. This type of buckle had been adapted in Bosporus from at least the 2nd century B.C. Bosporan craftsmen took the Sarmatian pattern of construction and included in it typical Greek elements (see above on p. 324).

*4.2.3.4. Greek Metalworking and its Influence on the Formation of New Centres of Toreutics and Artistic Metalwork*

With the establishment of independent states in the east of former Empire of Alexander the Great, toreutic ateliers and metalworkshops were set up in their capitals and in other important centres. Greek craftsmen worked there alongside local masters, especially in the first stages in their development. Thus, the 3rd-2nd centuries B.C. in Western Asia saw the creation of metalworking centres with quite individualistic styles. Their output included the bronze mirrors with handles in the shape of naked female figures found in Western Iran. A Bactrian toreutic centre probably manufactured several silver dishes and bowls with rich decoration, including floral patterns, representations of war elephants, hunting and libation scenes, and even episodes from Greek tragedies[349].

The migration of the Antiochian artists to Armenia, led to the formation there of a peculiar toreutic centre, which absorbed the metalworking traditions of the Eastern Mediterranean and the Middle East.

Greek sculptors and founders also worked at the courts of barbarian kings and for their temples. As an example I shall mention the fragments of a bronze statue of a cavalryman and inscribed bases from Scythian Neapolis[350], as well as numerous pieces of the

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[347] U. Hausmann, 1962, 280-281, Beil. 79, 1-2.
[348] See, e.g. E. von Mercklin, 1928, 496, Abb. 204.
[349] M. Colledge, 1987, 149-150.
[350] M.Yu. Treister, 1988, 154-155.

late 2nd-early 1st century B.C. bronze sculptures from the Vani excavations[351]. It has been suggested that the statues from Vani were undoubtedly produced by visiting Greek masters or by local counterparts, who were well-acquainted with the canons of Hellenistic art and techniques of casting bronze[352].

Analysis of toreutic articles acquired recently by the J. Paul Getty Museum led M. Pfrommer to the conclusion that in the 3rd-2nd centuries B.C. in the North-Western Iranian provinces, perhaps on the South-Eastern shore of the Caspian Sea, there existed toreutic workshops whose products display both Hellenistic Greek, Achaemenid and Central Asian features. Only an area which fell under both Seleucid and nomadic Central Asian influences could be seen as the place of origin of the horse trappings now in Malibu. The area that most closely fulfils these conditions is North-Western Iran (the former satrapies of Parthia and Hyrcania), which was occupied by the Parthians in the decade between 240 and 230 B.C. Silver cups from the same treasure were manufactured in several workshops all in the same area. The remoteness of North-Western Iran would also explain the survival of Early Hellenistic forms among the ornaments of the vessels. M. Pfrommer maintains that after the Parthian invasion of Iran the flow of Greek-trained craftsmen must have slackened, at least for a time, so that the Greco-Macedonian ornamental repertoire adopted in Early Hellenistic times could have been retained longer here than was the case in other parts of the Hellenistic world. Nevertheless, scroll ornaments indicate that new forms reached the now Parthian-controlled workshops during the first two centuries of Parthian dominance[353].

The silver vessels from Treasure IV in the J. Paul Getty Museum, dated to the 1st century B.C., are ultimately linked to a Greco-Bactrian or, in their roots at least, to a Seleucid tradition of the 2nd century B.C., which may have continued in use after the collapse of Hellenism as a political power in the Indo-Greek as well as the Partho-Indian world[354].

Barbarian craftsmen imitated Greek bronzes as well: for instance, the sculptured handle attachments in the shape of heads

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[351] O.D. Lordkipanidze, 1989; G.R. Tsetskhladze, 1991, 138.
[352] O. Lordkipanidze, 1991, 192.
[353] M. Pfrommer, 1993, 10-13, 20, 46.
[354] M. Pfrommer, 1993, 57, 64.

of Athena from situlae of the second half of the 4th-early 3rd century B.C. served as prototypes for La-Tène reproductions[355]. The diffusion of Greek culture in the Celtic environment, even among armourers, is proved by a stamp with the name of an armourer, Korisios, marked in Greek on a Late La-Tène sword from Port[356]. Like the famous Late Hellenistic Greek artists, Pasiteles and Arkesilaos, who settled in Rome, Greek bronzeworkers and toreuts, working for the courts of the rulers of Armenia and Commagene, contributed to the development of Parthian art[357].

A model for the influence of Classical centres on the formation of local schools of artistic metalwork is given by the Sarmatian school of toreutics. In the second quarter of the 1st century A.D. there existed "a school of Ampsalakos", which was given the name of the craftsman marked on one of the items of a set of silverware found in a rich Sarmatian burial in the Lower Volga region[358]. Articles from this school are extremely peculiar, combining shapes, motifs and techniques typical of Sarmatian, Central Asian, Late Hellenistic Syrian, and Parthian art as well as that of the neighbouring areas. There is reason to suggest that the tradition of using techniques and borrowing stylistic elements already had a long history by the period discussed. A group of 3rd-2nd century B.C. silver gilt phalerae, found mainly in Sarmatian burials in the south of Eastern Europe, should be first considered in this context[359].

Researches into Hellenistic toreutics in recent decades allow us to say precisely which artistic centres influenced the evolution of this peculiar style. We shall discuss only some of the most characteristic motifs used in decorating phalerae. A central element in many of them is a rosette composed of four willow leaves interposed by strongly stylised acanthus leaves. M.Pfrommer discusses

[355] R. Gebhard, 1989.

[356] R. Wyss, 1954; R. and V. Megaw, 1989, 158, fig. 240. Some scholars consider punchmarks on some La Tène swords as those of the owners of the swords. So, e.g. R.G. Livens (1972) argued that the name of Korisios had been that of the owner, added later after his return from Italy. However, a certain number of punchmarks on the La Tène swords must have been struck with the same tool, and this eliminates the theory that the marks were those of the owners of swords (R. Pleiner, 1993, 48, note 5; 64-65).

[357] D. Schlumberger, 1985, 42, 71.

[358] See M.Yu. Treister, 1994a.

[359] See about phalerae from Sarmatian burials: A. Spitsyn, 1909; M.I. Rostovtzeff, 1926; J. Harmatta, 1970, 34-39; K.F. Smirnov, 1984, 75, fig. 29, 1-2, 4; 85, fig. 38, 5; 87, fig. 39, 3; 103, fig. 48; 111, fig. 52; 112-113.

in detail the evolution of this motif on ceramics (primarily in Megarian bowls) and in Hellenistic toreutics[360]. If one accepts the view of K.F. Smirnov which seems to be reasonably near to the truth, then as with the school of Ampsalakos, the creation of stylistically contemporaneous pieces may have been the result of fairly transitory contacts between Sarmatian craftsmen and toreutic centres in the Hellenistic East. There is reason to think that the stimulus was rather Asian Minor-Syrian than "Indo-Greco-Bactrian"[361]. Are there any historical events to corroborate this? I think it is possible to date it to the time at which the Sarmatian king Gatal entered into a political treaty with the Pontic king Pharnakes I (Polyb. XXV. 2) and when the Sarmatians were in Asia Minor as part of the forces of Mithridates Eupator (App. Mithr. 18-21. 112). This hypothesis is supported by the dating of the articles, which served as prototypes for the decoration of phalerae and by the probable identification of the centres in which they were manufactured. My idea fits in well with the recently proposed schemes to explain imported items in Sarmatian burials, in particular cast glass kantharoi and those pieces of La-Tène and Etruscan origin. However, on the whole it would seem clear that the development of a Sarmatian toreutic school is associated with workshops and craftsmen, who set up next to the courts of the Sarmatian kings and travelled with them[362].

### *4.3.1. Prices of Metals and Changes in Recipes for Alloys*

A study of Hellenistic recipes for alloys, both those used for coins and for metal objects, proves the following connection: the gradual reduction in tin content and the growth of lead concentrations[363]. Two factors influenced changes in alloy recipes.

The first factor was a permanent one: the relative cheapness of lead in comparison to tin. We have no information about metal prices in the Hellenistic period, however, as I mentioned above, in the Classical era the price of tin was approximately 70-140 times higher, while in the 1st century A.D. Pliny (N.H. XXXIV. 161)

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[360] M. Pfrommer, 1987, 104-105, 122-124, Taf. 58c.

[361] A probably Syrian origin of some silver ware from Greco-Bactria is supposed by D. Strong (1966, 120).

[362] See in details: M.Yu. Treister, 1994a.

[363] P.T. Craddock, 1977, 107-110; 1988, 55-58.

stated that 1 libra of tin cost 80 denarii, whereas the price of the same weight of lead was only 7 denarii, i.e. tin cost more than 11 times more. The increase in lead additives in Hellenistic bronzes was thus due not to technological, but to economic reasons, because only lead concentrations of under 2% could improve its casting properties[364]. Probably the change was also influenced by the fact that lead was a by-product of silver extraction, which flourished in antiquity[365].

The second factor was a temporary one: the interruption of supplies of metal as a result of the depletion of deposits, changes in trade routes due to wars, and the disappearance of spheres of influence. A graph drawn by E.R. Caley on the basis of analyses of Mediterranean coins, reveals a sharp increase in lead concentrations and a falling off of tin in coins from the junction of the first and second quarters of the 2nd century B.C.[366]. In his opinion, the main reason for the reduction in tin concentrations in coins in antiquity was the interruption of the sea trade between Carthage and the regions in which tin was mined. This led to a melting down of old spoiled coins at the time of the First Punic War[367].

A study of local coinage allows us to distinguish their peculiarities and the growths and reductions in the components of alloys.

Analysis of silver coins from Italy of the late 4th-3rd century B.C. lets one correlate changes in their metal composition with known historical events. Italic cities minted a considerable quantity of silver coins in 330-275 B.C.; that can be explained by the wars, which were originally conducted with the local tribes of Italy, and later on with Rome, which thus made necessary payments to mercenaries. This increase in silver coinage, as A. Burnett has shown, eventually benefitted the growth of prosperity in Southern Italy[368]. The Pyrrhic War of 282-275 B.C., which resulted in Rome becoming the dominant power in Italy, led to the decay and cessation of Italic minting and, by contrast, to the development and highpoint of Roman silver coinage after ca. 270 B.C. There was a brief interruption at the beginning of the Second Punic War (218-201 B.C.) during Hannibal's invasion in Italy[369]. The more or less

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[364] P.T. Craddock, 1988, 55; P.T. Craddock, A. Giumlia-Mair, 1988, 319.
[365] A. Burnett, P.T. Craddock, N. Meeks, 1986, 129.
[366] E.R. Caley, 1939, 188-189.
[367] E.R. Caley, 1939, 190.
[368] A. Burnett, 1986, 31-40.
[369] A.M. Burnett, D.R. Hook, 1989, 151-153.

stable metal composition of coins, which was characteristic of the various Italic centres before 280 B.C., proves that the mints held sufficient stocks of silver to cater for an increase in the level of coinage in wartime. Later on the cities of Southern Italy had insufficient supplies of silver and were forced to reduce the silver content of their coins. Ten years later in some centres, like Tarentum, there was a further reduction in the silver content to 80% of the original level (fig. 47)[370]. The original silver content of Roman coinage did not differ from that of Italic cities; it increased sharply to 98-99%, as we saw earlier, just after the end of the First Punic War, which has been explained as the resolution of financial difficulties[371]. However it may be the case—as has been recently suggested—that this change was already taking place in wartime, meaning it was probably connected not only with the end of financial problems, but with the adoption of a specific Roman coin standard as well[372]. The prevalence of so-called "*pegasoi*" in Sicilian hoards has been dated to approximately the same period. These coins were traditionally thought to have been minted at Corinth. It has been suggested that imitations of Corinthian coins were struck by other cities, who often overstruck the coins of other centres[373].

Coins from the time of the Libyan War, conducted by Carthage against local tribes, and following the First Punic War, were not only struck in traditional tin bronze but also in bronze with high arsenic additives of 12-28%. Such an alloy was known neither in the bronze coins of Carthage, nor in those of Sardinia or Sicily. It appeared in Africa for the first time in the period of the Libyan War. Such arsenic bronze coins are typologically homogenous. It is thought that they were struck by the enemies of Carthage[374].

The invasion of Hannibal into Italy caused a crisis in the Roman monetary system, which was only ended after 212 B.C., when metal supplies were restored. The volume of war booty grew annually after the seizure of Syracuse in 212 B.C. to the conquest of Spain in 206 B.C.; from 209 B.C. metal from Spanish mines was brought to Rome[375].

Two crises occurred in the bronze coinage of the Kingdom of

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[370] A.M. Burnett, D.R. Hook, 1989, 156, 165.
[371] D.R. Walker, 1980, 56; M.H. Crawford, 1985, 51.
[372] A.M. Burnett, D.R. Hook, 1989, 158-159; O. Mørkholm, 1991, 87.
[373] R.J.A. Talbert, 1971, O. Mørkholm, 1991, 87.
[374] I.A. Carradice, S. La Niece, 1988; S. La Niece, I. Carradice, 1989.
[375] M.H. Crawford, 1985, 61.

Bosporus in the Hellenistic period. Both were connected with a sharp change in the composition of alloys. The first coincided chronologically with a monetary crisis in the second-third quarters of the 3rd century B.C., when a clear increase in lead concentrations was accompanied by a considerable reduction in tin content; sometimes even multicomponent alloys were used containing zinc and arsenic in insignificant quantities[376]. This coincided chronologically with the First Punic War, which cut traditional trade routes in the Mediterranean, perhaps also those by which tin was supplied to the Eastern Mediterranean. It is noticeable that Olbian coins of the 3rd century B.C. were also as a rule made of an alloy, which contained besides lead admixtures rather significant concentrations of arsenic and antimony[377].

The examples cited above provide eloquent proof that the First Punic War and its aftermath brought about a redistribution of metal stocks in the ancient world and as a result indirectly influenced changes in the compositions of alloys[378]. The Second Syrian War took place at practically the same time (between 262 and 246 B.C.) and resulted in a confrontation between Rhodes, as a powerful maritime state in the Eastern Mediterranean in the 3rd century B.C., and Ptolemaic Egypt[379]. It also destabilised the trade in metals between the Western and Eastern Mediterranean.

What was the relative value of various metals in the Late Hellenistic period? The proportion 1:120 reflected the value of bronze against silver, whereas silver and gold were valued at a rate of 1:8 (for comparison's sake this was 1:10 in the period of Alexander the Great). Alexander's control of Macedonian mines and Persian treasuries allowed him to maintain this rate, but from ca. 310 B.C. gold seems to have risen in value against silver. Apparently the ratio of 1:10 gradually gave way to a rate of 1:12 which was in effect around 290 B.C. Later on in the 3rd century an official rate of ca. 1:12.8 could not be maintained. In commercial transactions the rate was set at slightly above 1:13[380]. Due to an unprecedented glut of silver coins in Republican Rome by comparison to the situation in the Greek states, the cost of bronze probably rose slightly

[376] M.Yu. Treister, 1988a, 8-9.

[377] M.Yu. Treister, 1988a, 11.

[378] See about the influence of the First Punic War on the mintage of various centres of Italy: M.H. Crawford, 1985, 41-51.

[379] R.M. Berthold, 1984, 89-91.

[380] O. Mørkholm, 1991, 4-5.

and silver-bronze rate in the period of Augustus was 1:55[381]. However, the difference between the price of silver and bronze was so great that the universal introduction of bronze coins became more and more profitable, especially given that in the Hellenistic era a more expensive alloying metal (tin) was replaced by a cheaper one (lead). The profitability of bronze coinage was underlined in a decree of ca. 120 B.C. from Sestos in Thracian Chersonessos[382]. Even earlier the practice had begun of introducing into circulation bronze coin at an artificial rate, however this could not prevent its devaluation. A decree of Kanobes (IOSPE, I$^2$, 24) adopted by the Olbian *poleis*, which is dated to 340-330 B.C., cancelled the free circulation of electrum cyzicines in the local market; Olbian silver was considered to be the only basis for prices; alongside this locally cast copper coins were also permitted as a means of payment. However, the allocation of a monetary function to two metals at the same time without any attempt to divide their spheres of circulation turned the heavy copper coins into simple tokens, whose monetary function was to all intents and purposes independent of the amount of metal they contained, and this led to their devaluation[383]. State minting practice involved frequent changes in the types of money, reductions in weights, constant overstriking etc. If one analyses the situation in the Northern Pontic area, one sees a fairly synchronous pattern. For example, in Bosporus, these events occurred at the time of a monetary crisis in the second—third quarters of the 3rd century B.C.[384]. The reduction in bronze coinage "according to the calculations" mentioned in an Olbian decree in honour of Kallinikes (IOSPE, I$^2$, 25+31), whose career is dated by Yu.G. Vinogradov and P.O. Karyshkovskij to the events surrounding siege of Olbia by Zopirion in 331 B.C.[385], reflected the transition from the casting of heavy aeses to the striking of smaller coins in bronze. Silver coinage in Olbia ceased after the middle of the same century. To judge by a decree of the Olbian college of the Seven, published in

[381] M.H. Crawford, 1985, 59, note 19.

[382] L. Robert, 1973, 49-50; O. Mørkholm, 1991, 6.

[383] Yu.G. Vinogradov, P.O. Karyshkovskij, 1976, 20 ff.; Yu.G. Vinogradov, P.O. Karyshkovskij, 1982, 39-41; P.O. Karyshkovskij, 1988, 62-63.

[384] D.B. Shelov, 1981.

[385] Yu.G. Vinogradov, P.O. Karyshkovskij, 1982, 39-42; P.O. Karyshkovskij, 1988, 62, 66; Yu.G. Vinogradov, 1989, 150-176; cf. the point of view expressed by V.P. Yajlenko (1990a) about the dating of the decree to the second quarter of the 3rd century B.C.

the last quarter of the 3rd century B.C. (IOSPE, $I^2$, 76), the relinquishment of rights of coinage to that sacred board for an indefinite period aimed to underwrite this change not only by the authority of the deity, but perhaps by the financial resources of treasuries, which still existed in the sanctuary[386]. Among other financial subterfuges, practised by the state, were borrowing in gold and paying in depreciated copper. For instance, in a decree in honour of Protogenes (IOSPE, $I^2$, 32) it is stated that 1 gold stater had been changed into 400 copper coins[387].

The second crisis in the Bosporan mintage occurred in the first half of the 1st century B.C. and was characterized by a sharp increase in additions of tin and a considerable reduction in lead admixtures in alloys (90-80 B.C.), followed in 80-63 B.C. by issues of "pure" copper coins. This sharp growth in tin concentrations is unique in the Hellenistic era, which makes its explanation only more convincing. At the turn of the 2nd and 1st centuries B.C. an "archaic" alloy recipe of this kind was used only in the coinage of Amisus. I assume that the coins of this Southern Pontic city were used as scrap metal by the Pantikapaion mint[388]. The use of such large amounts of tin for alloying at Amisus mint can be explained only in terms of an accumulation of large stocks of this metal, for reasons which are unknown. Similarly, the absence of artificial admixtures in coins dated to 83-60 B.C. can be explained by the fact that trade in the Pontus basin in the sixties B.C.was virtually paralysed as the result of the Roman-Pontic wars[389]. This unpredictable use of alloying metals in the Pontic area is closely paralleled and possibly even explained by the coinage of Mithridates VI. As has recently been shown by statistical studies of Mithridatic coinage, the activity of Mithridatic mint was many times higher in periods before military campaigns, i.e. in 96, 92, 89 and 75 B.C. (fig. 48, 1)[390]. This means that in the eve of such campaigns large stocks of metals had been accumulated in the mints. A similar variable tempo in mintage occurred in the last years of the reign of Alexander the Great, when the mass disbandment of units of veterans and mercenaries led to a sharp increase in the mintage of some centres: these monetary tribunals probably provided de-

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[386] P.O. Karyshkovskij, 1976; 1988, 66 ff., 92-93.
[387] P.O. Karyshkovskij, 1988, 93-96; Yu.G. Vinogradov, 1989, 208-209.
[388] M.Yu. Treister, 1988a, 14.
[389] M.Yu. Treister, 1988a, 14.
[390] F. De Callatay, 1987.

mobilised soldiers with money; this type of mintage was also typical of the Ptolemaic mints in the 3rd century B.C.[391].

### *4.3.2. Trade in Metals*

1. Underwater exploration of a vessel which sank near the town of Kyrenia on Cyprus revealed a mixed cargo containing amphoras, millstones, and almonds. In the stern locker were found over 150 lead brail-rings, rigging pieces, iron ingots in bundles etc. The wreck is dated to ca. 310-300 B.C. The ship had a 14 ton displacement; 20 tons of cargo were found during the excavation. Of 404 amphoras 343 are Rhodian, while others are from Samos, Paros, Crete and Palestine[392]. As far as I know, this wreck is the only one containing metal ingots to be dated to the second half of the 4th century B.C.

Two wrecks with lead ingots can be dated to the 3rd century B.C. They are the following.

2. Agde K, France. A group of lead ingots, cast in oval moulds resembling *Pinna nobilis* shells, and inscribed , have been reported but without context. A date in the 3rd century B.C. can only be guessed by comparison with the ingots from Cabrera B[393].

3. Cabrera B, Spain. Four ingots of lead are known from the wreck, shaped like *Pinna nobilis* shells; the two which are available for study weigh 38.6 kg and 40.0 kg. The material stolen from this site in the years 1965-70 has been divided between several collections. It includes amphoras of several Punic types, Greco-Italic amphoras probably made in Catalonia or southern France, and black-gloss pottery, some or all of which was made near Rosas in Catalonia; several coarseware cups and jars and a jug are probably from Ibiza, a Punic colony; a standing dish and a louterion have parallels from Lipari and further east. The wreck dates to ca. 250-220 B.C. and is illustrative of the commerce of the Western Mediterranean region at the time of the First Punic War[394].

Two other wrecks which may be dated on the whole to the Hellenistic period cannot be given more precise datings:

4. Bajo de la Campana A, close to Isla Grosa, Spain. The main

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391 M. Thompson, 1984; C. Carcassone, A. Davesne, 1987.
392 A.J. Parker, 1992, N 563.
393 A.J. Parker, 1992, N 17.
394 A.J. Parker, 1992, N 124.

cargo of this wreck is said to have comprised amphoras of the Mañá type E, which cannot pre-date the 2nd century B.C. Also found were a number of elephant tusks, inscribed in a Phoenician script characteristic of the 5th and 4th centuries B.C., although some of the names are Punic rather than Phoenician. Also found were unstated quantities of lentoid tin ingots, 'fusiform' lead ingots, and lead ore. Unfortunately, not enough details have been given about the site to clarify the nature and extent of contamination, which might enable the identification of two or more wreck cargoes[395].

5. Agde G. A cargo of tablets of litharge (red lead), weighing about 100 tons. The wreck is described as Greek and of the 5th-2nd centuries B.C. by J. Marèchal, but no evidence for this dating is mentioned[396].

The rest of the Hellenistic wrecks belong to the Late Hellenistic period. The majority of them contained lead ingots.

Lead ingots

6. Algajola, Corsica. 44 lead ingots without inscription found over an area of 200 sq m with a few Dressel 1A amphoras, dating to ca. 150-100 B.C. (?)[397].

7. Agde J. A group of lead ingots of Republican Spanish type with mould marks L.PLANI.L.F.RVSSINI, SOC GARGILI TF ET M LAETILI ML, and SOC.M.C.PONTILIENORVM.M.F. The ingot of L. Planius Russinus is exactly the same as two ingots found in the Mahdia wreck (see below on p. 354), which dates this site to the late 2nd-early 1st century B.C.[398].

8. Bajo de Dentro, on Cabo de Palos, Spain. Over a ton of inscribed lead ingots has been raised. The mould-marks on the ingots include M.AQVINI.C.F., C.MESSI.L.F, C.VTIVS.C.F, M.SEX.CALVI.M.F. and L.PLANI.L.F.RVSSINI. The total number of recorded ingots appear to be 49. A Lamboglia 2 amphora dates the wreck to the 1st century B.C. (?)[399].

9. Cap Spartel, west of Tangier, Morocco. At least 40 lead ingots

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395 A.J. Parker, 1992, N 83.
396 A.J. Parker, 1992, N 14.
397 A.J. Parker, 1992, N 33.
398 A.J. Parker, 1992, N 16.
399 A.J. Parker, 1992, N 81.

with rounded tops were found. The best-preserved ingot weighed 26 kg. There were also lead pipes of various diameters, a lead bar and an anchor-stock. Date: ca. 100 B.C.-50 A.D. (?)[400].

10. Cartagena B, Spain. Naval divers recovered 15 lead ingots in 1962-1963, together with part of a Campanian plate. Thirteen of these bear the mould-mark dolphin—C.AQVINI.M.F.—anchor, one the mark L.PLANI.L.F.—dolphin—R [VSSINI], and one the mark—C.FIDVCI.C.F.—S.LVCRETI.S.F. Date: 1st century B.C.[401].

11. Punta dell'Arco, at the south point of the island of Ventotene, Italy. A cargo of Dressel 1B amphoras was discovered together with 14 lead ingots, apparently all marked with dolphin—C.VTIVS.C.F.—caduceus. Date: ca. 100-50 B.C.[402].

12. Bay of Madrague. Three lead ingots with Latin stamps weighing 30-31 kg each were found with Dressel 1B amphoras and Campanian pottery[403].

13. Punta Falcone, three miles from Punta Falcone, Sardinia. 16 lead ingots have been found; they are rounded in shape, marked C.VTIVS.C.F.—dolphin. Date: ca. 100-25 B.C. (?)[404].

14. Gavetti, in the Strait of Bonifacio, Corsica. Nine lead ingots were found together in a mixed context. They are of Late Republican shape, possibly Spanish, with marks in three cartouches; one, marked SOC, is lost. Date: 1st century B.C. (?)[405].

15. El Hornillo, close to Puerto El Hornillo, Aguilas, Murcia, Spain. The cargo consisted mostly of Dressel 1C amphoras, but there were also lead ingots, of which 15 have been recovered; of these 13 were inscribed Q SEI.P.F.MEN POSTVMI. Date: ca. 80-50 B.C.[406].

16. Scoglio Businco, between Capo Mannu and Isola dei Porri in north-western Sardinia. In 1966-67 seven lead ingots with rounded backs were raised. Five are unmarked; two have one mould-mark (illegible) and, on one of the long sides, the counterstamp CERDO. Date: mid-late 1st century B.C. (?)[407].

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400 A.J. Parker, 1992, N 199.
401 A.J. Parker, 1992, N 273.
402 A.J. Parker, 1992, N 932.
403 A. Tchernia et al., 1978, 72.
404 A.J. Parker, 1992, N 939.
405 A.J. Parker, 1992, N 439.
406 A.J. Parker, 1992, N 507.
407 A.J. Parker, 1992, N 1051.

Lead and brass ingots

17. Les Magnons B, on the last rock of Les Embiez, France. Nineteen lead ingots were raised, weighing from 7 to 28 kg; they were of roughly-cast shape, marked with symbols and some Greek letters. There were also small, yellow ingots (20-50 cm long) of plano-convex form; these were 79% copper, 21% zinc. There is no dating evidence. It is said that there is a resemblance between some of the lead ingot inscriptions and some from Ploumanac'h, which suggests a date not earlier than the Late pre-Roman Iron Age[408].

Iron bars

18. Dramont C, on the south-east side of Ile d'Or, France. About 50 long iron bars were found together with a cargo of 120 Dressel 1B and a few Lamboglia 2 amphoras, dating the wreck to the late 2nd century B.C.[409].

The find at Bajo de la Campana A (N 4) seems to connect two wrecks: they were from near the coast of Israel (Megadim; see below on p. 358) and contained tin ingots and from El Sec, proving the important role of Punic traders in the trans-Mediterranean metal trade of the 5th-4th century B.C. The tin may have originated from the mines of north-western Spain, where it is known to have been mined in the 4th-3rd centuries B.C. (see above on p. 294). It is significant that the vessel may have transported metal (lead) both in form of ingots and ore. Of interest in this context is the find of a large amount of litharge in Agde G, although the exact dating of cargo is obscure.

The find from Cabrera B (N 3) seems to confirm the role of Punic merchants as traders of metals at least in the Western Mediterranean in as late as the third quarter of the 3rd century B.C. In spite of views expressed recently by C. Domergue and P. Rouillard[410], I feel that the vessel was Punic rather than Greek: it is striking that the finds of coarseware pottery probably originate from the Punic colony on Ibiza and that there are several types of amphora of Punic origin in the cargo of the ship. However, there

[408] A.J. Parker, 1992, N 620.
[409] A.J. Parker, 1992, N 373.
[410] C. Domergue, 1990, 168: "vu la diversité de ce materiel, il est difficile de dire la nationalité du navire"; cf. P. Rouillard, 1991, 208: "la 'nationalité' du navire reste toutefois inconnue".

is an important difference between the composition of the cargoes from El Sec and Cabrera. The ship which sank at El Sec had crossed the entire Pontic and Mediterranean basins, whereas the ship from Cabrera was most probably travelling from the coast of Catalonia to southern France, calling at the islands on the way, and thus limited its range to the Western Mediterranean. This was much more similar to commerce characteristic of the late 2nd-1st century B.C.

The lead ingots from Agde K (N 2) have been mentioned by C.J. Eiseman as parallels of those from Porticello. The find from Cabrera, which produced lead ingots of the same shape and moreover from a well-dated context, poses many questions. First of all, is it really possible to compare these lead ingots, especially given that those from Porticello have a weight of ca. 25.7 kg, while those from Cabrera weigh 38.6 and 40.0 kg? Another point is the clear chronological difference between the ingots from Porticello of the late 5th and those from Cabrera of the mid-3rd century B.C. We have already mentioned above that similar lead ingots originate from a wreck in the bay of Campese from ca. 600 B.C. The context of the wreck from Cabrera firmly suggests that the lead ingots originated from Spain, whereas lead isotope analyses of the ingots from Porticello tend to suggest their provenance from Laurion ore. These differences lead us to suppose that the shape of these lead ingots is a chronological (Pre-Roman) than a geographical characteristic. The lead ingots in the shape of *Pinna nobilis* shells have most recently discussed by C. Domergue[411], who outlines the three possible areas for their production: the mines of Laurion, those of Sardinia and those of Cartagena in Spain. Domergue identifies two series of ingots of the type discussed. The find from Agde belongs to the first series and is thought to be of Iberian origin. The second series is represented by the finds from Cabrera. These ingots were most probably produced in mining areas on the Mediterranean coast of Spain, either at Sierra de Cartagena, or Sierra Almagera, which specialized in the commercial manufacture of lead ingots of the *Pinna nobilis* shape. That the Sierra Almagera mines were indeed exploited in this era is proved by finds of Iberian amphoras and a fragment of an Attic lamp of the late 5th-early 4th centuries B.C.[412].

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[411] C. Domergue, 1990, 168 ff.
[412] C. Domergue, 1990, 168.

The Late Hellenistic wrecks N 5-15 are only found in the Western Mediterranean, chiefly near the coasts of Spain and France, Corsica, and Sardinia. Wrecks are known from near the Italian and Moroccan coasts. As has been already stated, such wrecks containing lead ingots reflect the trade in lead from Iberian mines to Italy past Gaul. Normally from 7 to 15 ingots are found, however there are also records of several wrecks with ca. 40-50 ingots, indicating that cargoes of lead usually did not contain more than 1 ton of metal. By comparison with average cargoes, the cargo of the ship which sank at Agde G is unusual with about 100 tons of litharge. However this does not seem impossible in the Hellenistic period, if one takes into account the estimated cargo of the ship that sank at Mahdia: this was capable of taking on board up to 300 tons (63 marble columns weighing ca. 260 tons). And the Mahdia ship was not the largest known from this time, indeed it was a stone carrier (*lithegos*) of average size[413]. Perhaps, the most important aspect is the beginning of really large-scale importing. According to the evidence of dating from wrecks the beginning of this process should be dated to the late 2nd century B.C.

What is very important is the find of both lead and brass ingots (N 17). As far their dating is concerned, if there is really a resemblance between some of the inscriptions from Les Magnons and Ploumanac'h of the Early Imperial period[414], then this wreck can only possibly be dated to the second half of the 1st century B.C. at the earliest. This corresponds not only to the dating of the Ploumanac'h wreck, but to the general chronology of the early use of brass. An alloy with such a high zinc content was typical of the Augustan period, when alloy like this (*orichalcum*) was used for coining sestertii and dupondii at two Imperial mints: in Rome and at Lugdunum. According to Pliny the Elder, Marius or Cordova copper (N.H. XXXIV.2) (mined in the mountains of Sierra Morrena) was used for these issues[415].

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[413] G. Hellenkemper Salies, 1992, 510 (communication by O. Höckmann).

[414] See: *Objets métalliques sur les épaves antiques*, 1984, 13 ff.; F. Braemer, 1986, 147.

[415] See: E.R. Caley, 1964; P.T. Craddock, 1978; 1990; P.T. Craddock, A.M. Burnett and K. Preston, 1980; A.M. Burnett, P.T. Craddock and K. Preston, 1982; M.Yu. Treister, 1990c, 35-36; cf. D. Haynes, 1992, 86-88: "in the later fourth century the Greeks began to produce brass themselves and to use it for casting small objects". Haynes' view is based on several record of small objects of *oreichalkos* in the 4th century B.C. Athenian inventories (D. Haynes, 1992, 91, note 31). Although there are known several Hellenistic objects with artificial zinc admixtures,

The wreck at Dramont C is one of two Late Hellenistic wrecks that contain iron ingots. Another wreck, Bagaud B, will be discussed below. Iron bars in wrecks are much more typical of Roman wrecks of the first centuries A.D., fifteen of which have been recorded[416]. This type of seaborne trade in metals may have just been appearing at that time.

Several other Hellenistic wrecks with metal ingots deserve special discussion.

The remains of a shipwreck from the last quarter of the 2nd century B.C.—first quarter of the 1st century B.C. found near the island of Bagaud (off the southern coast of France, to the east of Toulon) yielded 46 tin ingots weighing ca. 25 kg each and bearing round stamps: TON PERI HERAKLEIDEN HYPO KELTON (fig. 48, 2) and iron ingots each weighing 2-3 kg. The ship's cargo included Italic amphoras and Campanian pottery; among the coins found there was a chalkos of Massalia. The stamps on the ingots prove, according to the interpretation offered by L. Long, that tin mines were worked by a Greek, Heraklides or his contractors in the land of the Celts (?), although the place is unknown. Long claims to localise the tin deposit in Huelva, assuming that the metal could have been carried via Tartessos[417]. However, difficulties in interpreting the text of the stamp force us to look for another explanation than that offered by Long. Thousands of legend formulas in coins and ceramic stamps show that the construction TON PERI HERAKLEIDEN should logically be finished by the name of a magistrature, which contains the letters YPOKEL. The prefix YPO-, which refers to some minor subordinate position, should be read as the first component of the letter combination. The absence of any elements in Greek nomenclature beginning with KEL- suggests that this is part of a Latin term for an occupation. An investigation in this field would be justified because Latin influence in the Southern Gaulic-Iberian region could not have been any weaker than, for example, it was in the Greek-speaking cities of Italy. One term, referring to a position or profession, which fits well in Latin, is *cellararius* or *cellarius*, the Greek transliteration of which, KELLAPIOS, is often found in papyri. If

the practice of cementation, allowing to produce alloys with high zinc admixtures seems to be a Late Hellenistic invention.

416 A.J. Parker, 1992, 17.

417 *Objets métalliques sur les épaves antiques*, 1984, 29-31; L. Long, 1988; *Gallia Informations* 1 (1987-1988), 29-30; *BEpigr* (1989), N 154; C. Roden, 1989, 125; A.J. Parker, 1992, N 77.

one adopts this suggestion, then *hypocellarii* would have been members of a board of junior contractors headed by Heraklides. *Cellarii* and, correspondingly, *hypocellarii* were not city magistrates, but employees of some private company, possibly owned by Heraklides himself, who supervised the mining and storing of tin and certified with stamps the quality of metal smelted. The emblem—Hermes in a petasus—which may have been borrowed from an uncial of Carmona in Iberia, could have been the insignia of a firm based in Southern Gaul or possibly in Spain[418].

A vessel wrecked near Mahdia carried a cargo, which included marble columns, sculptures and statuettes in marble and bronze, a candelabrum, a krater etc. At the same time, 12 lead ingots were found here each weighing 31-35 kg and bearing Latin stamps[419]. A. Merlin saw the ingots as Attic[420]. It is thought that the inscriptions on the ingots are to be dated to the early 1st century B.C., to the period before the seizure of Athens by Sulla. However, as A. Merlin himself said, the name Planii occurred in Narbonian Gaul as well as in Southern Italy[421], whereas ingots, similar in shape and weight and also bearing Latin inscriptions, were found in the neighbourhood of Carthage, where there were mining works in ancient times (Polyb. X. 10. 11; Strabo. III. 2. 10)[422]. All this has led to a rather critical view of the hypothesis that the ingots had an Attic origin. C. Domergue has convincingly shown that the Mahdia ingots were being carried from Iberian mines[423]. Besides ingots with stamps of the Planii there were pieces with stamps of Cn. Atellius T. f. Mene(nia) tribu. Atellius is known from another find as a lead manufacturer in Cartagena, and was, in B. Liou's opinion, an Italian from Campania, a Roman citizen and a member of the tribus of Menenia. It has been suggested that Atellius was only able to obtain Roman citizenship after the Civil War of 89/88 B.C. Although, it has been suggested that the ingots found in Mahdia were not intended for trade, but had been taken on board as material for repairs, this does not seem very likely, given the mixed character of the cargo and its similarity to the other

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418 M.Yu. Treister, Ju.G. Vinogradov, 1992; M.Yu. Treister, 1992, 36-37.

419 A. Merlin, 1912; W. Fuchs, 1963; *Marine Archaeology*, 1965, 41-52; G. Hellenkemper Salies, 1992.

420 B. Barr-Sharrar, 1987, 23, note 46.

421 A. Merlin, 1912, 387, note 5.

422 A. Merlin, 1912, 390, note 3.

423 C. Domergue, 1965.

cargo from this period[424].

A. Sherratt evaluates on a macro-scale the world system from the 4th century B.C. onwards and holds that as Greek demands on the resources of the Central and Western Mediterranean tailed off in the 4th century—with the development of the Hellenistic Empires, a deeper involvement in the East and the extension of Black Sea interests—so Italy became less crucial as a trading partner and Etruscan interests in the north less vital to the Mediterranean as a whole[425]. However, to judge by the archaeonautical and archaeometallurgical data the situation surrounding the supply of unrefined metals seems much more complicated.

One may maintain with a high degree of certainty that the character of the seaborne trade in metals in the Hellenistic period in the Western Mediterranean was fairly similar. There were probably no voyages exclusively to transport ingots: they were carried in various quantities as part of mixed cargoes on vessels which sailed from Spain to Italy past Gaul or made coastal trips throughout that part of the Mediterranean[426].

How did metals in ingots, in particular tin, which was so important for alloying, reach the Eastern Mediterranean?

Archaeonautical data seems to confirm (see above) that tin was carried from Iberian mines both in the Early and Late Hellenistic periods, in the earlier period possibly by Punic traders, later on by a Greek company headed probably by a certain Heraklides. C. Rolley has put forward a hypothesis based on the supposed relations during the second half of the 4th and beginning of the 3rd century B.C. between Tarentum and the Ambians, a Celtic tribe living in the north-west of France. The Ambians once they started striking their own gold coins imitated one or more Tarentine gold pieces of the period 340-272 B.C. Rolley maintains that Tarentines, keen to acquire British tin, sailed through the Western Mediterranean, along the Iberian coast all the way to the Pas de Calais, to return with their ships filled with the precious cargo[427]. M. Stoop discusses C. Rolley's view and thinks that it seems very likely that the famous Tarentine stater reached the Ambians in payment for tin, however, in her opinion, there would

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424 G. Hellenkemper Salies, 1992, 529-530.
425 A. Sherratt, 1993, 42.
426 F. Braemer, 1986, 156, fig. 3.
427 See C. Rolley, 1987a, 19; cf. 1990b, 374-376.

not be much sense in shunting metal eastwards along the Channel by land, across to France and then back along the Channel by sea. Once it arrived in the territory of the Ambians, it must have followed one or other of the various overland routes, being handed from one intermediary to another[428].

Where were raw metals obtained, for instance those necessary for metalworking in Ptolemaic Egypt? M.I. Rostovtzeff suggested that silver was brought from Iberia, whereas tin came from Britain via Carthage, which controlled Iberia in this period[429]. P. Rouillard also suggested that in the 3rd century B.C. Iberian silver was distributed via the Western Greek colonies, primarily Massalia, basing this on Aristotle's statement (De mir. ausc. 87) that the Massaliotes derived large profits from Iberian silver[430]. O. Mørkholm has maintained that the Ptolemies had a problem with silver, as the only mines under their direct control were insignificant ones in Cyprus. Most silver had to be imported into Egypt, but a positive trade balance was sufficient to secure a reasonable flow of this metal into the country. There can, however, be no doubt that the relative importance accorded to gold and bronze coinage in the Ptolemaic monetary system from ca. 260 B.C. onwards was largely caused by difficulties in acquiring silver[431].

According to P.M. Fraser, although there is no historical or archaeological corroboration of Rostovtzeff's idea, it seems to bear some truth and reflects the situation before the Second Punic War. The fairly frequent finds of Ptolemaic bronze coins in Britain are thought to have been imported as metal. The complete absence of any Ptolemaic silver coins, as P.M. Fraser has suggested, show that bronze coins too were not brought there in the course of direct trade links: even if Alexandria obtained tin from Britain, then this occurred only through intermediaries, either Carthage or Massalia. There is practically no evidence for the character of contacts between Egypt and Iberia: Ptolemaic coins are unknown there[432], and the only evidence is a dedication to

[428] M. Stoop, 1990.

[429] M.I. Rostovtzeff, 1941, 396; cf. O. Mørkholm, 1991, 4.

See about the specific role of Carthage in the distribution of metals (the Punic merchants in the epoch discussed controlled the trade in the Iberian metals, however, Carthage, for a single exclusion, was not directly involved in the exploitation of mines of the Iberian peninsula): C. Domergue, 1990, 167 f.

[430] P. Rouillard, 1991, 208; see also O. Mørkholm, 1991, 4.

[431] O. Mørkholm, 1991, 4.

[432] See the map of the Ptolemaic bronze coins distribution in Europe: P. Visona, 1979, 159, fig. 6.

Serapis by an Alexandrian at Emporion, a colony of Massalia. However, it is dated to not earlier than the 1st century B.C., i.e. to the period after the fall of Carthage when Egyptian trade relations had changed as result of the Third Punic War. Nevertheless, one cannot exclude the possibility that some of the silver was supplied from Cyprus; the importance of its silver mines is proved by a passage from Eratosthenes[433]. R.J. Forbes thought that the Ptolemies had intensified output of silver not only on Cyprus, but in the south-western part of Asia Minor as well, where they also mined iron (Strabo. XIII. 4. 17)[434]. W. Huss suggests that the role of metals in trade between Hellenistic Egypt and Carthage should not be exaggerated, because Ptolemaic Egypt made use of metal deposits on its territories, especially in Cyprus, while the Carthaginian trade in metals had been constantly falling off from the 5th-4th centuries B.C.[435]. However, it seems that Rostovtzeff and Fraser were nearer to the truth. This particularly touches the import of silver and tin. The mines of Cyprus could hardly have met all the needs of Egypt for silver. At any rate, from at least the late 6th century B.C. Egypt had used Greek silver coins as its metal source, and hoards of such coins, primarily of Attic origin, have been found in significant quantities in Egypt[436]. However, while the import of metals via Carthage could not have occurred in any considerable volume before the Second Punic War, but it could have taken place before the First in the mid-3rd century B.C., because judging by analysis of silver and bronze coins from various Mediterranean and Pontic centres, there were significant changes in this period in the distribution of metal sources and the direction of trade routes in metals.

O. Mørkholm holds that it seems certain that the vast majority of minor coin-producing states had no mines of their own and were thus forced to acquire metal either directly by purchase or through their income from tolls and duties of various kinds, possibly also in some cases from liturgies exacted from wealthy citizens[437]. In this respect, it is worth remembering that the production of coins in precious metals by Greek cities was generally conducted on a very reduced scale in the period from ca. 280 to ca.

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433 P.M. Fraser, 1972, 153, 158-159.

434 R.J. Forbes, 1963, 143; cf. O. Mørkholm, 1991, 4.

435 W. Huss, 1979, 132. See about the role of Phoenician traders in the Hellenistic intermediate trade in the Aegean basin: M.F. Baslez, 1987.

436 A.B. Lloyd, 1975, 30-31.

437 O. Mørkholm, 1991, 3.

240 B.C. Mørkholm states that there were exceptions to this rule, e.g. at Rhodes and Byzantium, but taken as a whole this period represents the highwater mark of royal coinages, while those of free Greek states were at a low ebb. Only in about 240-230 B.C. does the balance seem to change slowly in favour of the cities and, more especially, of the leagues which were then beginning to play a more important role in the international concert of powers[438].

The wreck at Cabrera (see above on p. 347)—and particularly if it represents a typical cargo—suggests that at the time of the First Punic War trade in metals—at least in the Western Mediterranean—was conducted by Punic merchants.

The interruption of the trade links that supplied tin to the Eastern Mediterranean in the late first-early second quarter of the 2nd century B.C. is reflected in a change in the metal composition of coins[439]. This urgent need for metal was probably the reason behind the principal differences in the character of the Late Hellenistic trade in metals in the Eastern Mediterranean. There is no evidence for any seaborne trade in ingots in this period in this part of the world.

There was a notable find off the Israeli coast at Megadim in 1982, which dates from ca. 140-130 B.C. From this were recovered a Rhodian amphora, containing ca. 100 kg of various types of scrap metal: bracelets and pieces of bracelets, parts of fittings, nails, and arrowheads, as well as coins, weights and the tools of a jeweller. Nearby were separate finds of fragments of statues, vessels, furniture details, and nails. It has been suggested that the entire cargo of this vessel consisted of scrap metal. The ship may have been sailing from one port, where there were stocks of scrap metal, to another; nevertheless the authors of the publication are inclined to think that the vessel may have belonged to a trader in metals, who like the merchants from Hanaan, sailed from port to port buying and selling supplies of scrap metal to be resmelted[440].

Somewhat different in character from the Megadim find are those shipwrecks with pieces of Greek bronze statuary of the 5th-4th centuries B.C., from Riace[441], Antikythera[442], Artemision[443],

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[438] O. Mørkholm, 1991, 160.

[439] E.R. Caley, 1939, 124, fig. 3; M.Yu. Treister, 1992, 38.

[440] O. Misch-Brandi, E. Galili, 1985, 12-16; A.J. Parker, 1992, N 689.

[441] C. Houser, 1983, 51; *Due Bronzi da Riace,* 1985; A.J. Parker, 1992, N 985.

[442] P.C. Bol, 1972; A.J. Parker, 1992, N 44 (Antikythera A) with references. See also note 446.

[443] C. Houser, 1983, 91; A.J. Parker, 1992, N 57 with references.

and Fano[444]. At Les Saintes Maries-de-la-mer B in France, a bronze satyr, 0.51 m in height, was brought up by a trawler in 1967. The same trawling run also produced some amphoras and 'stones'—possibly column-drums. This wreck should probably be dated to the 1st century B.C.[445]. These sunken finds were in ships carrying works of Greek art to Rome in the late 2nd-1st centuries B.C[446]. Whether one should consider the sculptures hidden at the time of Sulla in Piraeus and found in 1959, as an irreversible deposit[447] or as a cargo about to be sent to Italy, they should at any rate be discussed in the context of the Roman wars with Mithridates VI[448]. The shipwrecks at Mahdia and Antikythera date to approximately the same period[449], while that from the bay of Huan—with a cargo of sculptured appliques, inlaid with silver and copper, belonging to one or more couches of bronze, and with an inscription indicating Greek manufacture, and other utensils—may be dated to ca. 80-60 B.C.[450]. Besides an intact bronze statue of an athlete, the shipwreck of Antikythera was found to contain bronze statuettes as well as some badly damaged bronze sculptures, including the head of a "Philosopher" and the torso of a peplophore; and also intact marble statues, fragments of statues and bronze details from couches[451]. One can hardly describe the character of the cargoes from Antikythera and Mahdia, as has been done earlier, as "purely predatory". The finds rather speak in favour of the fact that the cargoes were intended for trade, while the Antikythera cargo may be defined as of a mixed type[452]. This would be especially true of the finds from Mahdia and the bay of Huan. A final conclusion must however wait on the publication of the latter shipwreck. This is shown to be the case for the

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[444] J. Frel, 1982, 4-5; A.J. Parker, 1992, N 396.

[445] A.J. Parker, 1992, N 1012.

[446] A.J. Parker, 1992, 17 with references. See N. Yalouris, 1990 about the new evidence of date of the shipwreck of Antikythera: the Pergamene silver coins of 85-67 B.C. and Ephesian bronze coins of 70-60 B.C. It is maintained that the origin of the whole cargo, especially of excellent sculptures in marble and bronze must have been the coast of Asia Minor and more precisely Pergamon.

[447] M. Donderer, 1992, 251-253, N 2.

[448] M. Paraskevaïdis, 1966, B.S. Ridgway, 1990, 363.

[449] Recent researches suggest the date from ca. 100 to 75 B.C. to the Mahdia shipwreck (G. Hellenkemper Salies, 1992, 507).

[450] C. Rolley, 1986a, 194; A.J. Parker, 1992, N 425.

[451] P.C. Bol, 1972.

[452] P.C. Bol, 1972, 118-119; B.S. Ridgway, 1984, 9, 13, note 33; B. Barr-Sharrar, 1987, 25-26.

Mahdia shipwreck by new and chronologically similar finds[453]. The trade character of the Mahdia cargo is also supported by D. Baatz's studies. Four massive bronze naves from the torsion mechanisms of catapults should, to judge by contemporary pieces, be dated approximately a century earlier than the date suggested for the shipwreck. The absence of any other weapons allows us to think that these details were carried as scrap metal[454]. It is difficult to define precisely the route of the ship that sank at Mahdia. F. Braemer suggests that the wreck proves the existence of a route connecting the eastern and western parts of the Mediterranean along its southern coast[455].

Thus, along with trade in metals in the form of ingots in this period there was wide-spread trade in scrap metal, particularly of the fragments bronze statues, which already existed, to judge by an analysis of the Porticello finds, in the Classical era (that fragments of bronze statues were used as scrap metal in the Hellenistic period is confirmed by finds from Vani). In some cases (Megadim and Mahdia) these two forms of trade in metals were combined[456]. It is obvious then that the volume of the seaborne trade in bronze objects grew in the Hellenistic era.

If one assumes that trade in tin and, probably, silver from the mines of Iberia to the Eastern Mediterranean and the Pontic region was undertaken largely by the Rhodians[457], whose largest trading partner in the West was Carthage[458], then in the course of the first half of the 2nd century B.C. and with the growth of Roman supremacy, Rhodes' share of long-distance seaborne trade would have been falling. This is reflected in a fall in the number of finds of Rhodian amphoras in Italy and Sicily[459]. Two critical events were the Roman sanctions against Rhodes in 167 B.C.—which led both to the reduction in the size of the Rhodian fleet and in the scale of trading operations—and the fall of Carthage in 146 B.C.

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453 B.S. Ridgway, 1984, 9, 13, note 37; C. Rolley, 1986a, 194.

454 D. Baatz, 1985.

455 F. Braemer, 1986, 142; 1993, 303, 306.

456 M.Yu. Treister, 1991, 237-238; 1992, 38-39.

457 Perhaps, it is proved by the hoard of Rhodian coins, found near Valencia. See: Yu.V. Gorlov, 1990, 198. The gifts of the Hellenistic monarchs after 228 B.C. earthquake on Rhodes are justly considered as not a pure charitable action, having no precedents for that time- all these states were more or less involved in the system of trade relations executed by the Rhodian traders. See: R.M. Berthold, 1984, 93.

458 R.M. Berthold, 1984, 230.

459 R.M. Berthold, 1984, 230.

My hypothesis about the significant role of Rhodes in Hellenistic trade in metals is confirmed by a recent find there of a domestic workshop for processing lead ore. As no deposits of lead-silver ores are known on Rhodes, it is thought that not only metal, but also ore were imported to the island[460].

Another important event was the Roman exploitation of the silver mines in Spain from at least 179 B.C. This may have originally been undertaken by individual contractors, but was later done by stock companies, *societates publicanorum*. The largest body of evidence for Roman extraction of precious metals from Spain is Livy's record of the amounts of silver, gold and minted coin brought back to Rome by various governors. The ore that was mined round New Carthage was an argentiferous lead, and after the silver had been extracted by cupellation, a considerable quantity of lead would have been produced as a by-product[461]. Finds of stamped lead ingots in wrecks in the Western Mediterranean date however mainly from the late 2nd-early 1st century B.C. (see above on p. 348 f.).

### *4.3.3. The Distribution of Metal Objects*

#### *4.3.3.1. Trade*

Tracing the range of distribution of Hellenistic metal objects is not without problems, particularly because there has been little adequate study of mass-produced metal articles and because they cannot be attributed to individual manufacturing centres with any certainty. One of the best opportunities for doing so may be offered by analysis of metal appliqué ornaments and the details of couches. During excavations at Delos finds were made of moulds for casting bronze details of couches and of the only known cast bronze appliqué in shape of a silene mask, which belong to couches of types I and II respectively, according to the typology suggested by S. Faust[462]. On this basis one could assume that couch details of these types were manufactured in a Delian work-

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460 E. Kakavoyiannis, 1985. Traces of the mining activity in the area of southwest necropolis of Rhodes of unknown period have been revealed in the recent excavations. See: E.B. French, 1991, 66.

461 J.S. Richardson, 1976.

462 S. Faust, 1989, 131.

shop, and then use the distribution maps published by Faust (figs. 49-50)[463]. Finds of couch details of the types mentioned above originate mainly from south-west Asia Minor and from Greece, i.e. with a concentration not very far from Delos, however other articles were found in the Kuban basin, Central Italy and the Mahdia shipwreck.

A relatively short-lived phenomenon was the import in the second half of the 4th century B.C. of Greek bronze situlae—considered until quite recently to be not of Southern Italian, but of Northern Aegean (Macedonian, Thracian?) origin—into the area north of the Alps (Waldalgesheim, Keldby) as part of a remarkable and hitherto little recognized flow of luxury goods of high quality which emanated from or via Etruria[464]. However these finds may also reflect contacts other than commercial ones[465].

Of special importance is the so-called hoard found near the village of Peschanoe in the Dnieper basin, which according to O.D. Ganina was probably the cargo of a 5th century B.C. Attic merchant[466]. Most of the bronze ware found here was produced in Greek centres in the 5th-4th centuries B.C.; also found was a situla of Etruscan or Macedonian manufacture, which has been given dates by different scholars varying from the 5th to the 4th centuries B.C., but at any rate not later than 320-310 B.C.[467]. W. Fuchs thinks that because of the considerable chronological differences between the 15 bronze vessels found in Peschanoe there is no reason to define the complex as the cargo of a ship, however there is no doubt that the hoard belonged to a trader in metal vessels and is to be dated to ca. 300 B.C.[468]. A.J. Graham argues that the shipwreck from Peschanoe is a unique example of a shipwreck in a river. The large differences between the dates of the vessels and in their values are, in his opinion, remarkable. The find cannot be considered to be the result of the intermediation of the local population, which, as Graham argues (see above), usually managed the inland trade, both overland and along the rivers, between the Greek colonies and the barbarian settlements[469]. If one

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[463] S. Faust, 1989, Karte 1-2.

[464] B. Shefton, 1985, 409-410.

[465] C. Rolley, 1990b, 372: "On renonce en tout cas peu à peu- pas assez vite!- à expliquer tous les vases de bronze grecs du domaine celtique, surtout oriental, par le pillage de Delphes".

[466] O.D. Ganina, 1970.

[467] M.Yu. Treister, 1991a, 74-75.

[468] W. Fuchs, 1978.

[469] A.J. Graham, 1984, 8-9.

adopts Graham's view that the Greek votives found in local barbarian sanctuaries were offered by Greek merchants (see above), then one can also make a case for the view that in this period Greek merchants played a significant role, at least in inland trade, in the Northern Pontic area. This view is supported by finds from the local Taurian sanctuary in the Crimean mountain area, which existed during the Hellenistic period and in the first centuries A.D.[470].

With the decay of the empire of Alexander the Great Eastern Hellenistic states were formed. Workshops in these states manufactured articles in both pure Greek and Greco-Eastern styles, however these centres also began to obtain articles of Greek production. Up to the mid-2nd century B.C. imports from Greece were of considerable importance: bronze statuettes have been found on some of the sites, especially in the cities founded by Greeks. For example, a group of figures—including Zeus, Apollo, and Artemis—a gilt figurine of Eros, and statuettes of horsemen and Isis from Laodikeia in Western Iran had probably been dedicated at a local sanctuary; bronze statuettes of Heracles originate from Aï-Khanoum and Pushkalavati. Finds of silver gilt Hellenistic statuettes are known in Parthia, in whose capital Nisa have been found statuettes of Athena, Eros, a siren, centaurs, a sphinx and an eagle. Later on the export of Greek metal objects reduced considerably[471].

It is worth tracing the movement of bronze sculptures probably cast by Greek founders. Mouseus Chorenatsy (History of Armenia, II, ch. 49) wrote that bronze gilt statues of Artemis and Apollo were installed in the first capital of Armenia—Armavir—having been brought there from the western regions of Asia Minor, because Artemis was identified with Anait, while Apollo was equated with Tyr. It was also said that the sculptures were taken from Armavir to the specially built cult city of Bagaran and that after the foundation of Artaksata, the new capital of Armenia, the figure of Artemis-Anait was mounted in the temple of Anait in Artaksata, whereas that of Apollo-Tyr was set up on a road near to Artaksata. The authenticity of this story by the Armenian historian is proved by the find of a fragment of a large bronze statue during excavations at Artaksata[472].

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[470] N. Novičenkova, V. Novičenkov, 1991.
[471] M. Colledge, 1987, 152, 158.
[472] G.A. Tiratsyan, 1978, 142; B.N. Arakelyan, 1982, 43-44.

*4.3.3.2. The Distribution of War Booty*

In the Hellenistic period the volume of dedications of objects captured in war at the sanctuaries grew in comparison to the previous period[473]. This was probably connected with the crisis of the *poleis* as the main form of the state and with changes in the structure of society. Enormous quantities of arms and armour were dedicated at the sanctuaries, this being probably the most usual form of self-propaganda[474]. For example, in 305 B.C. Demetrius Poliorketes sent to Athens 1200 sets of panoply taken in the battle off Salamis; he also offered shields at Delphi (Plut. Dem. 13. 17). After the victory of Pyrrhus, who commanded the combined forces of the Macedonians and the Galatians in 273 B.C., over Antigonos, Macedonian arms were dedicated at the sanctuary of Zeus at Dodona, whereas Celtic arms were offered at the temple of Athena Itonia between Pherae and Larissa (Paus. X. 1. 10). The scale of accumulation of arms at the leading Greek sanctuaries in the Hellenistic period can be shown by the following example, mentioned by Polybius (V. 8.9-9.1). When Philip V captured Thermon in 218 B.C., he found 15000 sets of arms stored in stoas, these most probably being war trophies. The soldiers exchanged some of their arms for those kept at Thermon and destroyed the rest of the stock. From Polybius' point of view this was in accord with the rules of war, although at the same he criticized the Macedonians for violating sanctity of the temples, claiming that his predecessors had never done anything similar[475]. In 211 B.C. after his victory over the Dardanians and the Medes Philip V dedicated as votives every tenth captured shield, helmet and sarissa in the comparatively small temple of Athena Lindia on Rhodes[476].

In Hellenistic times there seem to be fewer examples than before of spoils taken from Greeks being dedicated even in their own temples. This trend is anticipated at some pan-Hellenic sanctuaries from various dates in the 5th century B.C.[477].

With the growing importance of dedications of arms there developed a specific architectural form, usually associated with the exhibition of such arms and armour. The stoas, often built at the

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473 See: M. Launey, 1950, 901-914.
474 P.C. Bol, 1985, 64; B. Hintzen-Bohlen, 1992, 198.
475 W.K. Pritchett, 1979, 294-295; 1991, 165; A.H. Jackson, 1991, 244.
476 W.K. Pritchett, 1979, 245.
477 A.H. Jackson, 1991, 244.

leading Greek sanctuaries with money from the Hellenistic monarchs, became in the 3rd century B.C. the usual architectural context for dedications of captured military equipment[478].

Seleucus I dedicated at the temple of Apollo on Delos silver models of battleships: a trireme weighing 1544 drachms and a tetrere weighing 1700 drachms[479]. On the whole, the Hellenistic Greeks went one better than their classical predecessors in the matter of dedicating entire ships. Not only did they have ships much larger than the trireme to dedicate, which will made an even greater impact than before. But, as is shown by the ship dedications at Delos and at Samothrace, the arrangements for ship dedications could be more elaborate and permanent than simply beaching and dedicating a captured ship on the shore nearest to the site of a naval victory. For example, a building, the so-called "*Monument des Taureaux*" apparently designed to house a dedicated ship, has been discovered on Delos in the sanctuary of Apollo, although the question of who dedicated the ship is still open. It may well have been Antigonos II Gonatas, or Demetrius Poliorketes. A building designed to house a ship and dated to the first half of the 3rd century was recently discovered at Samothrace and has been tentatively associated with a dedication by Gonatas[480].

The enormous volume of offerings of utensils at the sanctuaries is shown, for example, by a gift by Seleucus I to the Milesian Didymeion[481]. The Hellenistic inventories of the Delian treasuries[482] show that in comparison to articles of jewelry, vessels in precious metals, and wreaths (for instance, in the temple of Apollo alone several thousand phialai were kept), the quantity, and especially, the value of dedications of arms was small. Nevertheless, such votives were quite important, and included a variety of objects from horse-bits to a ship; most of them were originally captured in the course of war[483]. In any event W.K. Pritchett considers that unlike the Athenian inventories practically all the arms

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[478] B. Hintzen-Bohlen, 1992, 196-197, cat. I, N 13, 29; IV, N 2, 4. For instance, the Galatian arms were exhibited in the so-called Western Stoa at Delphi: see B. Hintzen-Bohlen, 1992, 62-63, 65-66.

[479] W.K. Pritchett, 1979, 285.

[480] B. Hintzen-Bohlen, 1992, 198, cat. III N 16; E. Rice, 1993, 242-247.

[481] C. Gaspari, 1970. See also above note 218.

[482] See, for example: J. Tréheux, 1988; 1988a.

[483] W.K. Pritchett, 1979, 268-269.

mentioned in the Delian lists were votives[484]. The dedication by Alexander, son of Polyperhos, of his panoply to Athena in 318 B.C., and by Pyrrhus after his victory over Antigonos and the Galatians are the examples of victors offering their own arms[485]. However, given the special character of the Delian inventories, which were in fact endorsement lists rather than inventories, one would be justified in thinking that in reality more votives were stored in the Delian treasuries[486].

Apart from this it was common practice in the Hellenistic era to dedicate old arms at temples. This is shown by a *stratagem* employed by Polyaenus (III. 8). Before Archinos became tyrant of Argos in 266-263 B.C., the Argives had ordered new arms, which were issued to the citizens at public expense. According to the Argive decree, their old arms were to have been offered to the gods. Instead of doing this, Archinos distributed the old arms to metics and foreigners, and used their help to become a tyrant. The custom of dedicating one's own arms or arms seized in wartime by private persons is testified by epigrams from the Palatine anthology and by the inventory lists of sanctuaries[487].

The practice of capturing works of art made by Greeks from Greeks seems to have become more common in the Hellenistic period. For example, in 198 B.C., when the combined fleets of the Rhodians and Romans took Eretria the spoils consisted chiefly of works of art: "There was no great quantity of money, gold or silver; statues, paintings of ancient workmanship, and adornments of that sort were found there in greater abundance than was to be expected, considering the size of the town or its wealth in other respects" (Livy XXXII.16.17). It is suggested that these works of art were in private hands. The per capita wealth was small, but a few were very rich[488]. Some of the works of art became were seized as booty more than once, changing nationality with their new owners. Thus when Scipio sacked Carthage he found the city full of Greek statues and votive offerings which had come from Sicily. Diodorus (XXXII.245) writes, "Many portraits of famous men were found, many statues of outstanding workmanship, and not a few striking dedications to the gods in gold and silver". When

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[484] W.K. Pritchett, 1979, 263.
[485] W.K. Pritchett, 1979, 245, 271.
[486] T. Linders, 1988.
[487] M. Launey, 1950, 901-914; W.K. Pritchett, 1979, 249-251.
[488] W.K. Pritchett, 1991, 193f.

these works of art were transported to Rome in 211 B.C., Polybius (IX.10.12-13) said that such as came from private houses were used to embellish Roman houses and those from public buildings were distributed among civic structures[489].

As in the Classical period valuables stored in temples were seen as the reserve capital of a polis for use in case of war or an extremely difficult economic situation. As a consequence of instances in which sanctuaries were plundered by an enemy, Greek city-states not infrequently removed objects and money from sacred treasuries to meet the emergencies of war, with the intention of repaying them as soon as danger had receded[490]. This occurred, for example, in Olbia when the archons were forced to pawn sacred vessels to a foreign usurer, Polycharmes, for only one hundred gold staters, however these were redeemed by an Olbian citizen, Protogenes (IOSPE, $I^2$, 32)[491]. In the late 2nd century B.C. in Chersonessos a bronze statue of Diophantes was cast from money from the treasury of the local sanctuary (IOSPE, $I^2$, 352)[492].

### *4.3.3.3. "Technological Redistribution"*

An increasingly higher proportion of the spoils of war bypassed temple or royal treasuries legally or illegally and came into the hands of mercenaries. These amassed such wealth that it became a common theme for boasting by mercenaries in Hellenistic comedies. For example, during the Parthian campaign of Antiochus VII ordinary warriors fastened their boots with gold clasps, used silver ware etc. (Iustin.Hist. XXXVIII. 10. 3; Val.Max. IX. 1, ext. 4)[493].

The practice, known from earlier periods, of re-using captured arms and armour for different purposes continued. The best example from the Hellenistic period is perhaps the sale on Rhodes of the siege equipment left behind by Demetrius Poliorketes when he finally abandoned the siege (Diod. XX.82-88; 91-100). The Rhodians sold the lot, and with the proceeds they commissioned from Chares of Lindos a statue of their patron god Helios, the famous Colossus of Rhodes, in thanksgiving for their deliver-

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489 W.K. Pritchett, 1991, 166.
490 W.K. Pritchett, 1991, 194-95.
491 P. Gauthier, 1985, 70-72; Yu.G.Vinogradov, 1989, 209.
492 V.I. Kadeev, 1981, 71-72, note 58; 81.
493 E. Bikerman, 1938, 91.

ance. Pliny (N.H. XXXIV.41) records that the statue cost 300 talents, although Philo of Byzantium (De septem orbis miraculis 4.6) says that it cost 500 talents of bronze and 300 of iron[494].

The practice of melting down the statues of state enemies, known in the earlier period, was frequent adopted in Hellenistic times, by both Greeks and Romans, when they conquered Chalcis (Livy. XXXI. 23.10) and Corinth (Polyb. XXXVI.13.1)[495]. Worthy of note is an example where this happened to the statues of Demetrius of Phalerum. Strabo (IX.1.20) reports that "the statues of him, more than three hundred, were pulled down by the insurgents and melted down, and some writers go on to say that they were made into chamber-pots" (transl. by H.L. Jones). Plutarch also mentioned 300 statues (Mor. 820E). Other sources even make mention of around 1500 statues, which were destroyed by the Athenians in a single day (Dio.Chr. XXXVII.41).

Perhaps, even more significant numerically was the practice of melting down and re-casting the small private dedications at sanctuaries for official priestly dedications. S. Aleshire has studied 3rd-century B.C. inscriptions from the Athenian Asklepeion, and notes that near the end of his year as a priest or early in the following year, a priest was permitted to choose a small private votive object, especially if it was small, to be melted down with other objects and—supplemented by additional silver provided by the priest—to be re-cast as a larger and more impressive votive labelled with the priest's name and his priestly title *ek ton typon*. If a votive escaped being chosen by a priest for melting down and rededication *ek ton typon*, the priest remained responsible for its continued presence in the temple in subsequent years. Finally, after a given time the *boule* and *demos*, probably at the urging of an enthusiastic and active priest, could decree the general melting down and re-casting of votives into larger and more conspicuous cult objects. Thus, the silver from a small dedication could come to form part of a larger votive object, itself part of the official silver service of the cult[496]. Who undertook such re-casting? There was probably a limited group of experienced metalworkers, like, for instance, Nikokrates of Kolonos, who was under contract to serve the Treasurers of Athena at least from 334/3 to 311/10 B.C. He worked in gold and silver and created a variety of shapes of

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494 See, e.g. H. Maryon, 1956; R.A. Higgins, 1988; D. Haynes, 1992, 121-128; E. Rice, 1993, 235-236.

495 M. Donderer, 1992, 225, 271-274.

496 S.B. Aleshire, 1992, 98.

ritual vessels, including the hydria, pinax, oinochoe, chernibeion, escharis and phiale. His name was inscribed on or is associated with at least twenty-six vessels[497].

### *4.3.3.4. Burial Inventories*

A tendency for the number of metal objects in burials to grow received a further stimulus in the Hellenistic era. Excavations of Hellenistic necropoleis in Southern Italy, the Northern Pontic area, and the Eastern Mediterranean have produced considerable numbers of ornaments and utensils made of precious metals and bronze.

### *4.3.3.5. "Necrocorinthia"*

Strabo (VIII.6.23) preserves the following story about Roman excavations at Corinth after the city was conquered in 146 B.C.: "Now after Corinth had remained deserted for a long time, it was restored again, because of its favourable position, by the deified Caesar, who colonised it with people who belonged for the most part to the freedmen class. And when these were removing the ruins and at the same time digging open the graves, they found numbers of terracotta reliefs, and also many bronze vessels. And since they admired the workmanship they left no grave unransacked; so that, well supplied with such things and disposing of them at a high price, they filled Rome with Corinthian "Mortuaries", for thus they called the things taken from the graves, and in particular the earthenware..." The elder Pliny (N.H.XXXIV.6) stated that other towns besides Corinth were plundered of their bronzes during the Roman conquest[498]. There is archaeological corroboration of "Necrocorinthia" in the find at Pompei of an Argive prize hydria of the 5th century B.C.[499].

### *4.3.3.6. "Irreversible Depositing"*

In contrast to earlier periods the number of sculptures, which were intentionally hidden is slightly bigger. M. Donderer sees as archaeological proof of irreversible depositing the find of an

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[497] D. Harris, 1988, 336, note 21.
[498] See, e.g. H. Payne, 1931, 349-351.
[499] M.-L. Lazzarini, F. Zevi, 1989, 33-48.

bronze equestrian statue, probably representing Demetrius Poliorketes, found in a well on the Athenian Agora[500]. Donderer's interpretation of such finds is not undisputed in every case. For instance, various views have been expressed concerning the sculptures found at Piraeus in 1959[501]. It is apparently also very difficult, if not impossible, to describe the intact bronze sculptures found in rivers as irreversible deposits, as Donderer suggests in the case of the statue of an ephebe from Agde[502], or as parts of commercial cargoes, or as war prizes.

### *4.4. The Role of Metals in Economic and Political Developments in the Hellenistic Era*

The data preserved in papyri concerning toreuts and jewellers in Ptolemaic Egypt shows that there was strict state control and registration of their work. It was thus not necessary to concentrate workshops near to the royal court: craftsmen settled in various centres in Egypt. In the 3rd century B.C. they worked mainly in the Fayum oasis, as well as at Oxyrrinchos and Thebes, while from the 2nd century to the first half of the 1st century B.C. they were centred in the Heracleopolitan nome, Tebtunis, Thebes, Latopolis and Philae. There are reasons to suppose that workshops, which existed before Alexander's conquest of Egypt, continued their work under the reign of the Early Ptolemies. Because workshops produced goods to state orders, these were in fact distributed in advance[503] and practically never reached private collectors outside Egypt. This was in contrast to toreutic production in the 1st-2nd centuries A.D. which was often manufactured in series for export to Italy[504].

As rewards for service Hellenistic monarchs, for example the

[500] M. Donderer, 1992, 219, 267, N V. 1.

[501] M. Donderer, 1992, 251-253, N II.2.

[502] M. Donderer, 1992, 199-200, 259, N III.2.

[503] One should remember enormous dedications of the Ptolemies in various sanctuaries: so, for instance, Ptolemy II sent to the temple in Jerusalem twenty gold and thirty silver bowls, two gold and three silver kraters etc., having a total weight of 3057 kg of silver and 2424 kg of gold. Fabulous are the descriptions of processions in Alexandria; the description of one of them made by Kalixenos from Rhodes is preserved by Athenaeus (V. 197-203). Among the miscellaneous ritual objects there are mentioned a crown composed of 10000 pieces of gold; three different type of Delphic tripods, eighteen in total, numerous gilded sculptures etc. See: E. Will, 1966, 178-184; P.M. Fraser,1972, 136-137; E. Rice, 1983, esp. 116-123; J.J. Politt, 1987, 280-281; L. Neesen, 1989, 148-149.

[504] F. Burkhalter, 1979, 74-85, pl. 32.

Seleucids (Polyb. V. 60. 3; Polyaen. IV. 6), dispensed marks of distinction—e.g. golden cuirasses, silver arms, and wreaths—or increased salaries[505]. Golden bowls, chains, bracelets, and buckles, which were distributed among courtiers, were tokens of closeness to the monarch[506].

Extremely expensive articles in precious metals and ornaments may, unlike for instance bronze objects, have only been produced to special order. It was probably the practice to draw up a contract between craftsman and client, which fixed working conditions and payment, as was the case, to judge by papyri, in Roman Egypt. An example of such a document is known—a contract for the making of bracelets with snake heads for a sum of 2816 drachms drawn up between a jeweller Mistos or Mistarion and a customer Herodos[507].

The most important customers of the Hellenistic epoch were the courts of Macedonia, Ptolemaic Egypt, and Seleucid Syria. Because of the need for large quantities of gold and silver and the dangers of transporting these over long distances, toreuts probably came to the customers[508]. The character of such workshops is difficult to define: were they always big ergasteries situated next to royal courts[509], or could they have been dispersed under centralized state control, as in the Ptolemaic Kingdom?

It is probably no coincidence that so many examples are known from the Hellenistic epoch, when monarchs visited the ateliers of artists and craftsmen and were aware of the problems of artistic production (Alexander the Great, Antiochus III, Attalus III)[510].

However, a new set of shapes characteristic of the Hellenistic period was also developed in regions, which had never been under the control of the Macedonian dynasty. The one exception is formed by the territories of Central Italy controlled by Rome, where no single ornament with a "Heraclean knot" of the Macedonian type has been found to date. It is true that the new combination of forms was established mainly in regions, in which the Greeks were dominant. This is proved not only by the case of Central Italy which was controlled by Rome, but also by the case of the

[505] E. Bikerman, 1938, 85.
[506] E. Bikerman, 1938, 42-44.
[507] J.E.G. Whitehorne, 1983; F. Burkhalter, 1990, 52-53.
[508] M. Pfrommer, 1983, 236-237.
[509] So, M. Pfrommer, stating the court character of the Macedonian workshops, designates them as "*makedonische Kunstbetriebe*".
[510] G. Zimmer, 1985, 39.

Northern Pontic area. Although there have been numerous finds of types of such ornaments in the necropoleis of the Greek colonies, such sets of ornaments are practically unknown in Scythian tumuli, despite the abundance of Greek imports to the area. The situation in Asia Minor probably developed in a similar way. In spite of the numerous shapes with Achaemenid prototypes, which were common in the Early Hellenistic period, the formation of the empire of Alexander the Great never led to such a flourishing of an Achaemenid repertory—the patterns discussed here were already included in Greek and Macedonian art in Pre-Hellenistic times[511]. Analysis of the chronology and distribution of ornaments decorated with the "Heraclean knot" shows one more unusual recurring feature: the decay of the Macedonian state marked the end of the typological development associated with it, although later on "Heraclean knots" were used as amulets. After the fall of the Macedonian Empire the repertory of the Hellenistic ornaments did without gold knots and knots decorated with insets of coloured stones, a combination which stressed their specifically Macedonian parentage. I should also mention the bad economic situation in both Macedonia and Southern Italy after their ruin by Rome—there were never again the clients, rich enough to patronise jewelry. There is however a more complex question. In spite of the fact that the Seleucid and Ptolemaic Kingdoms considerably outlived independent Macedonia (the first one lasted till 64 B.C., and the second till 30 B.C.), ornaments from the second half of the 2nd century to the 1st century B.C. are practically unknown in these kingdoms and there are no dating finds. On the other hand, there is evidence, at least for the Seleucid region, that the Hellenistic tradition of Central Asian jewelry survived even after the fall of the Seleucid state and of the Greco-Bactrian Kingdom[512].

Early Hellenistic Athens unlike somewhat later practice in the kingdoms of the Ptolemies and the Seleucids, probably did preserve forms of craftsman-client relations traditional to the Classical era, although clients were often represented by a polis. This is proved by analysis of the activity of a toreut, Nikokrates of Kolonos[513].

In some centres, for example in Epizephyrian Locri, an important role was played in the Early Hellenistic epoch by workshops

[511] M. Pfrommer, 1990, 1-3.
[512] M. Pfrommer, 1990, 74-75.
[513] D. Harris, 1988.

situated next to temples. This is shown by the sacred archive of the Olympeion on bronze plaques found there. For example, plaque 24 presents a passage from a decree concerning the financing of city's fortifications and its arms supply; mention is made of iron which cost 170 talents. A. de Franciscis does not rule out that these workshops belonged to the sanctuary[514]. A workshop near to the entrance of the temple of Zeus is mentioned on plaque 9; there metal was treated, which cost more than 160 talents. There are references to the manufacture and acquisition of arms and to the production of bronze doors for the Olympeion. According to a decree of the *boule* and *demos*, the doors cost 613 talents and 2 staters of silver[515].

Statistics concerning 3rd-century B.C. dedications at the Athenian Asklepeion recently compiled by S.B. Aleshire show that of a total of 1377 dedications recorded in the inventories, only 29, or 2.1%, can be considered to be official dedications made by priests in their capacity as priests or by the Athenian *demos* or one of its constituent groups. All other dedications were made by private persons. It is not necessary that the workshops attached to the sanctuary were in this case situated within it. It is suggested that silversmiths and goldsmiths were working nearby. Given that the standard weight of such dedications is less than ca. 8 drachms, Aleshire suggests that the dedications, which are mainly anatomical *ex votos* or *typos* in precious metals and weigh 1, 2, 4, 5 or 8 drachms, were prefabricated by the silversmith and offered for sale ready-made. The purchaser would then pay the silversmith the number of drachms of the weight plus an amount—to cover the costs of manufacture and profit—ranging from 16 to 33%[516].

In the Hellenistic period a close interaction developed between the Greek and Roman worlds. It has been suggested that from the second half of the second century B.C. the relationship between Rome and the Hellenistic world took on the form of a centre and its periphery, with Rome as the centre and the Hellenistic world as the periphery[517].

A significant episode was the closure of the Macedonian gold and silver mines after the defeat of Macedonia in the Third Macedonian War against Rome. Some scholars have suggested

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[514] A. De Franciscis, 1972, 123.
[515] F. Costabile, 1987.
[516] S.B. Aleshire, 1992.
[517] See, e.g. S. Podes, 1986, 201 ff., 340 ff.; 405-406.

that the Macedonian mines became the property of the Roman Republic. They were closed because the growth in the production of the metals led to their depreciation and to inflation. It has been maintained that Rome undertook the ruthless exploitation of Macedonian natural resources[518]. However, according to E.S. Gruen[519], the decision to close some mines and to make the working of others a duty was the result of an internal struggle at Rome between the senate and publicans, who wished to establish in Macedonia the same system of mining by contract which already existed in Spain: *senatus consultum* (Livy. XLV. 18. 3) makes no mention of the closure of the mines. Although it was divided by the Romans into four separate regions each with rights of internal autonomy, Macedonia nevertheless continued to mint silver coins between 167 and 148 B.C., and this was realized in the two districts in which the silver mines situated[520]. A decade later (in 158 B.C., according to "Chronicle" of Cassiodorus), when the conflict between the *patres* and *publicani* had lost its bitterness, the Macedonian mines were opened once more, however it is not clear under whose control: that of the Macedonians or of the Romans?[521] It has been maintained that the mines remained productive well into the first century, as is shown by the substantial issues of silver coinage from that period[522].

An important fact, in my opinion, is that the Romans allowed further exploitation of the iron and copper mines in 167 B.C. (Livy. XLV. 29.11). I tend to agree with J.S. Richardson concerning the reasons for the closure of gold and silver mines: he thought that this had to do with Roman fears about the possible political consequences of leaving control of the mines in the hands of the Macedonians. Livy states that if they were administered locally, this would be an everlasting source of discontent and revolt (Livy. XLV. 18.5): "It was impossible, the senate thought, for even the Macedonians to farm these resources; for where there was booty as a prize for administrators, in that state there would never be a lack of reasons for conspiracies and strife" (transl. by A. Schlesinger). Diodorus (XXXI. 8.6) is more explicit.

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[518] See the survey of various points of views, e.g.: E. Will, 1982, 281.

[519] E.S. Gruen, 1982, 262-264.

[520] M.H. Crawford, 1985, 128-129. The gap of nearly a decade in splendid Macedonian silver coinage between 167 and 158 B.C. resulted presumably from lack of bullion. See: O. Mørkholm, 1991, 166.

[521] E.S. Gruen, 1982, 264.

[522] O. Mørkholm, 1991, 3.

The senate, he says, "cut off the revenues derived from the gold and silver mines, partly to keep the local inhabitants from being oppressed, and partly to prevent anyone from stirring up a revolution thereafter by using this wealth to get control of Macedon" (transl. by F.R. Walton). It is easy to understand the senate's unwillingness to leave such a potentially dangerous source of wealth in Macedonian hands in the immediate aftermath of Perseus' defeat. Furthermore, Richardson suggests that this would also explain why, after a delay of nearly ten years, the senate seems to have been prepared to re-open the Macedonian mines[523]. However, M.H. Crawford suggests that the renewal of silver mining is explained by the fact that a certain volume of metal continued to be extracted after the prohibition, so that the granting of permission in 158 B.C. was recognition of a situation existing *de facto.* Perhaps Thasos and possibly Maroneia as well also gained access to the mines: like the two districts of Macedonia striking their own coins, Thasos renewed its issues of silver coinage in ca. 158 B.C.[524].

Another remarkable example is the financing of the construction of a theatre at the sanctuary of Dea Syria on Delos in 108/7 B.C. by a Roman family from Avil(l)ia, whose prosperity was based on metal extraction and metalworking in Italy[525].

It is usually maintained that there were no substantial innovations in the technology of crafts in the Hellenistic era. The inherent conservatism of Hellenistic goldsmiths was—to give a characteristic example—probably the reason for the continued use of Persian standards for weight for the manufacture of gold and silver plate long after the fall of the Persian empire. The use of the Persian standard is fixed, for example, in the inventories from the Rhodian Peraea of ca. 200 B.C., which presumably describes gold rather than silver phialai, suggesting that the daric was still the unit used in making plate[526]. However, one sphere where technological change occurred over a fairly short period of time was the manufacture of arms and armour. Hellenistic monarchs were constantly occupied in warfare and encouraged their military engineers to develop new more powerful and more accurate types of

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523 J.S. Richardson, 1976, 143-144. See other arguments against the theories of Roman economic imperialism: S. Podes, 1986, 170-209.

524 M.H. Crawford, 1985, 131. See also: O. Mørkholm, 1991, 166-167.

525 G. Cresci Marrone, 1993, 35.

526 M. Vickers, 1992, 69-70, table 9.

artillery[527], to modify the techniques of fortification, to build naval fleets[528]. One can assume that as in previous periods, the desire to improve military technology, to increase numbers of siege engines and ships, and to unify designs of arms and armour led to the development of large royal and civic ergasteries and arsenals; however, in the Hellenistic period this became common practice[529]. In that sense it is worth remembering the words of Strabo (XIV. 2.5), referring to Hellenistic Rhodes: there, as in Massalia and Cyzicus, great attention was paid to construction works, to the manufacture of siege engines and to the supply of arms and other equipment. In 220 B.C. when Sinope, a trading partner of Rhodes, was threatened by siege by Mithridates II of Pontus, Rhodes offered 140,000 drachms, which were spent on supplying 1000 sets of panoply and four catapults (Polyb. IV. 56. 1-9)[530]. Among the successors of Alexander Antigonos and his son, Demetrius Poliorketes had the most powerful artillery of the late 4th century B.C.[531]. In 306 B.C. when preparing for the siege of Salamis on Cyprus, Demetrius ordered the building of many siege engines with the help of craftsmen enlisted in Asia, from whence he brought wood, iron and other requisites (Diod. XVIII. 4. 2-4). The main centre behind the improvement of catapult mechanisms in the 3rd century B.C. was Alexandria in Egypt. Describing the invention of a formula for calibrating catapults, Philo (Bel. 50) stated that this was first done by Alexandrian craftsmen, who received considerable subsidies, because they had an ambitious king, who promoted the development of industry. According to E.W. Marsden, this took place no earlier than the reign of Ptolemy II[532]. At least some Alexandrian shipyards, which became big ergasteries in the Ptolemaic era, were primarily engaged in the construction and repair of warships belonging to the state[533]. Describing the resources accumulated by the Macedonian king Perseus on the eve of the Third Macedonian War, Livy (XLII. 12. 8-10) mentioned a supply of grain sufficient to maintain 30000 soldiers and 5000 horsemen for ten years, and enough money to

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527 D. Baatz, 1979; 1982; 1985.
528 F.W. Walbank, 1981, 194.
529 E. Will, 1966, 149; V. Ehrenberg, 1974, 86; S.-G. Gröschel, 1989, 125-126.
530 R.M. Berthold, 1984, 93-94.
531 E.W. Marsden, 1969, 76.
532 E.W. Marsden, 1969, 62.
533 L. Neesen, 1989, 160, Anm. 214.

payment 10000 mercenaries; in the arsenal enough arms were kept to equip an army three times bigger. Even if the scale is somewhat exaggerated, it is hardly likely that thousands of arms of all types could have been produced in small workshops. This is even more improbable, given that the economies of the largest Hellenistic monarchies were based to a considerable extent on mining and the accumulation of precious metals. Recently an arsenal was unearthed at Aï-Khanoum, dating to ca. 150 B.C., where the details of the armour of catafracts, who were perhaps auxiliaries in the Bactrian army, were found. The armour had not only been stored there, but produced there as well. The length of the arsenal—ca. 140 m—gives an idea of its scale[534]. F.W. Walbank described the economic system in Egypt as a large-scale experiment in bureaucratic centralism and mercantilism, because it aimed at accumulating precious metals by controlling trade and subjugating the economy to state power [535]. In the Late Hellenistic period there is further evidence of the manufacture of arms by the state or poleis. For example, 68 B.C. saw the start of arms production in the cities of the Kingdom of Pontus by Mithridates VI for his war against Lucullus (App.Mithr.12. 87), while the citizens of Massalia established armories after they had closed the gates of their city to Caesar (Caes. Bell. Civ. I. 34). M.C. Bishop discusses these examples from Hellenistic and Republican history as embryonic forms of the system by which the state manufactured arms and controlled their quality which was being established under the Early Principate[536].

It is also possible to maintain that there was substantial progress in the techniques of bronze casting. Arguing from the view of H. Maryon that the Colossus of Rhodes was not cast but composed of sheets of hammered bronze, D. Haynes maintains that Philo's description provides a basis for the suggestion that the statue was not cast in sections. Philo claims that the Colossus of Rhodes had a unique method of construction: all other statues were first modelled by an artist, then dismembered and cast in sections, and finally reassembled and erected. The only practical method of casting a statue of this enormous size was, he says, to do it *in situ* in horizontal layers, the first being cast onto a permanent base prepared for the work, the second onto the first, and so

[534] P. Bernard, 1980, 452-457; 1987, 762.
[535] F.W. Walbank, 1981, 104.
[536] M.C. Bishop, 1985, 16, 39, note 135.

on to the top layer. Before each layer was cast, it was necessary to build up the corresponding section of the massive internal armature which was needed to bear the weight of the bronze and to ensure the stability of the statue as a whole. Although, as Haynes suggests, the statue of Athena Promachos and some other earlier bronze statues were also cast *in situ* in layers their dimensions are in no way comparable with those of the Colossus of Rhodes. Estimating the total weight of the Colossus as about 200 tons (see below on p. 380), D. Haynes compares it with the 250 tons weight of the largest cast bronze statue now extant, the Great Buddha of Nara, cast in A.D. 747-749[537].

Greek bronzesmiths, especially in peripheral areas, like Greco-Bactria, were not restricted in their experiments, and created new alloys, for instance, cupro-nickel, which was in use at some time in the 2nd century B.C.[538].

R.J. Forbes maintained that it is difficult to estimate how active Hellenistic monarchs were in exploiting mineral resources, however pointed out that their activities aimed to obtain the best results and illustrates this thesis with an example from Strabo (XV. 1. 30). In the army of Alexander the Great during his Indian campaign there was a mining engineer, Gorgios, who surveyed the mines of the kingdom of the Sopites and prepared a report for Alexander. Besides salt deposits there were silver and gold mines which were worked in a primitive fashion by the Indians. In Forbes' opinion, Gorgios was not the only mining specialist in the army of Alexander, who organized mining on a more systematic, than the Indians had been done[539]. The question of whether Alexander conducted an "economic policy" has often been debated. Many scholars have maintained that Alexander was a great and even outstanding economist. According to F. Schahermeyer, coinage on the Attic standard, organized by Alexander using captured Persian treasuries, was supposed to help to unify the Empire. On the other hand, P. Briant and A.R. Bellinger have attacked such views, stressing the colossal non-productive wastage of Alexander[540]. While agreeing in general with adherents of the latter point of view, L.P. Marinovich holds that Alexander's measures in

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[537] D. Haynes, 1992, 121-128.

[538] M.C. Cowell, 1989.

[539] R.J. Forbes, 1963, 142; see also O. Mørkholm, 1991, 3 See about Indian metalworking in the epoch of Mauryan dynasty: G.M. Bongard-Levin, 1973, 85, 96-97.

[540] See bibliography: L.P. Marinovich, 1990, 98.

the field of coinage could be hardly called "policy"; the establishment of mints and striking of coins in the East were done to meet pure practical needs: the payment to the army, the foundation of cities etc., however, these actions started the runaway development of a monetary economy which was independent of Alexander' wishes[541]. O. Mørkholm also considers it anachronistic to ascribe any far-sighted economic policy to Alexander and his administration, suggesting it much more likely that Alexander and the diadoches simply issued coins on a huge scale to cover the military and civil expenses which they incurred. Finally, propaganda and prestige would sometimes have influenced the issue of coinage. Thus commercial considerations, the profit motive, the need to cover state expenditure, and prestige and propaganda were all factors that may have influenced the issue of coins[542]. The striking of coins from the immense stocks of gold kept in the Achaemenid treasuries first by Alexander, then by Lysimachus, Ptolemy and other diadoches led in the first quarter of the 3rd century B.C. to the following situation. The quantity of gold in circulation reached a maximum, so that the monetary functions of silver were transferred to gold, and at the same time the exchange rate of silver to gold was falling[543].

In Ptolemaic Egypt, Macedonia, and the Kingdom of Pergamon there was a royal monopoly in mining[544], and profits from the exploitation of royal mines were largely spent, as Livy records concerning the army of Perseus (XLII. 8-10), on military needs. To judge by the evidence of Agatharchides preserved by Diodorus (III. 12. 1. 3. 4; 14. 3), a large number of people besides free skilled workers and technical specialists were employed in mining in extremely difficult conditions. Among these were prisoners of war, condemned criminals, and the victims of unjust accusations, sometimes with their families. Thus, de jure these were not the slaves whose labour was exploited in the gold mines of Nubia in the Ptolemaic period, but free people made captive in wars or persons convicted for political or criminal actions[545], although some scholars consider the mine workers of Hellenistic Nubia to

[541] L.P. Marinovich, 1990, 98-99.

[542] O. Mørkholm, 1991, 23-24.

[543] C.T. Seltman, 1955, 204-206, 219-222, 241-243; P.O. Karyshkovskij, 1988, 64-65.

[544] R.J. Forbes, 1963, 142-144; M. Grant, 1982,70; E.G. Huzar, 1988, 366-370, H.S. Lund, 1992, 146-147.

[545] H. Wilsdorf, 1952, 176-177; K.K. Zel'in, 1969, 57-60.

have been slaves[546]. In considering how labour was organised in the Nubian gold mines, K.K. Zel'in stated that it was a special case of the use of a vast and complicated system by the Hellenistic state namely the application of the unlimited power obtained by the Ptolemies towards certain few categories of the population to achieve both political and economic aims[547]. Such practice was characteristic not of the Greek *poleis*, but of big centralized states of the Oriental type. Y. Garlan holds that the Hellenistic monarchies used a variety of forms of exploitation including non-economic ones. In his opinion, the sources seem to show that slavery was present primarily in the administrative system, not in the sphere of crafts[548].

The output of metal in the Hellenistic period was increasing by comparison to previous times. I have already mentioned that the output of the Polis region over the course of three centuries (from the Hellenistic to the Early Roman periods) has been estimated to be several hundreds of tons, which means about 100 tons a year. It had been estimated that in the Roman period the mines of the Rio Tinto district alone could have produced as much as 1000 tons a year[549]. Even given the increase of production in the Roman period, that its output in the Hellenistic period, at least after the period of active Roman mining from the 2nd century B.C., should be also estimated to be hundred(s) of tons annually. Another piece of evidence for the volume of metal production in the Hellenistic world is Philo of Byzantium's description of the construction of the Colossus of Rhodes: "The maker used up so much bronze on it that the mines were in danger of being exhausted; for the casting of the work was an operation which eventually involved the bronze industry of the entire world" (De septem orbis miraculis 4; cited after D. Haynes). Haynes maintains that if the Colossus had been cast, it would necessarily have required much more than the 500 talents (12.98 tons) of bronze Philo says was used for it, especially given that the demand for this 12.98 tons of bronze could have been spread over the twelve years it took to complete the Colossus. Haynes suggests that the figure given by Philo is an error and uses the evidence provided by Theophanes of Byzantium (Chronographia

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546 See, e.g.: J.F. Healy, 1978, 133-134.
547 K.K. Zel'in, 1969, 61.
548 Y. Garlan, 1982, 131-133.
549 J. Healy, 1978, 195.

I.345) that when the statue was broken in A.D. 653 and sold it was transported by a caravan of 900 camels, to calculate the total weight of the Colossus as some 7700 talents or about 200 tons of bronze[550].

This desire to accumulate stocks of precious metals was reflected in a protectionist monetary policy[551], i.e. in the tendency to exclude foreign coins from circulation in the internal market, to force the exchange of foreign coins for local lighter ones, as was done in Egypt[552]. This system, which was established in the reign of Ptolemy II by ca. 285 B.C., was later adopted by the Attalids, who started the coining of cistophores[553]. These measures, as happened with manufacture for the military, led to my mind to the formation of big and productive mints, in fact ergasteries on a scale comparable with the large armories. This is clearly shown by a letter of Demetrius, an official in charge of the Alexandrian mint, to the *dioiketes* of Ptolemy II dated to 258 B.C. which refers to the overstriking of 57000 old gold coins[554]. One might suppose that the activity of monetary courts in Alexandria and Pergamon was not limited to the striking and overstriking of coins. Philip V of Macedon also clearly increased the output of coins, and for the first time in the history of his dynasty gave the right of issuing coinage to several Macedonian cities. Somewhat later in 169/8 B.C. a similar action was undertaken by Antiochus IV in Syria[555]. Certainly alongside the big ergasteries and mints that existed in the Hellenistic monarchies, there were small ones, meeting the needs of small Greek cities, like the 3rd century B.C. monetary court of Chersonessos, found during excavations in the last century.

That enormous stocks of metals (in bullion, coins and objects) accumulated in the treasuries of the Hellenistic monarchies is proved by the following examples.

Alexander the Great had captured in Persia 2200 metric tons of precious metals, which, once turned into coin, led to serious economic shocks. A similar after-shock was brought about by the removal by the Romans of 550 tons of silver from the East—in the

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550 D. Haynes, 1992, 121, 125.

551 See about the bank system in the Ptolemaic Egypt, which included both state and private banks: R. Bogaert, 1987.

552 A. Gara, 1984, 1985.

553 P. Kinns, 1987.

554 P. Cairo Zen., 59021=Select Papyri, N 409; F.W. Walbank, 1981, 105.

555 F.W. Walbank, 1981, 88-89.

first half of the 2nd century B.C. alone—in the form of booty and tribute, including 150 tons sent from the Balkans. It is worth remembering the description handed down by Diodorus of Marcus Aemilius' triumph after his victory over the Macedonian king Perseus (XXXI. 8.9-13): "On the first day the procession opened with twelve hundred waggons filled with embossed white shields, then another twelve hundred filled with bronze shields, and three hundred more laden with lances, pikes, bows, and javelins...There were many other waggons as well, carrying arms of various sorts, and eight hundred panoplies mounted on poles. On the second day there were carried in procession a thousand talents of coined money, twenty-two hundred talents of silver, a great number of drinking-cups, five hundred waggons loaded with diverse statues of gods and men, and a large number of golden shields and dedicatory plaques. On the third day the procession was made up of ... talents of gold conveyed in two hundred and twenty carriers, a ten-talent bowl of gold set with jewels, gold-work of all sorts to the value of ten talents..." (transl. by F. Walton). Even the "modest" spoils taken from the Nabataeans in 312 B.C. included besides myrrh and frankincense 500 talents (13 tons) of silver (Diod. II.48; XIX.94-100; Plut. Dem. 7.1)[556]. For comparison: the stocks of silver thought to be present in Greece in the 6th-4th centuries B.C. are estimated at approximately 400 tons[557].

It has even been suggested that the change from black or grey mold-made pottery to red ware in the Eastern Mediterranean in the mid-2nd century B.C. may have primarily reflected the larger amount of gold available in the Eastern Mediterranean as a result of Alexander's conquest and a similar change in Italy in the mid-1st century B.C. may mirror the sudden arrival of booty with the triumph of Lucullus in 63 B.C.[558].

During excavations of the treasury in the palace at Aï-Khanoum, dated to the post-Greek period and ruined in ca. 145 B.C., 115 gold and silver ingots were found, including one with an inscription in an unknown language which may be that of the Yueh-chi nomads. Besides these were found labels from the vessels used for storing silver[559].

According to Polybius (V. 88-89), after the destructive earth-

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[556] M. Vickers, 1994, 231.

[557] J.F. Healy, 1978, 197-198.

[558] M. Vickers, 1994, 239.

[559] P. Bernard, 1980, 437-442; C. Rapin, 1983, 349, N 30; 351 ff.; 1987, 57-58; 1990, 342, note 51.

quake on Rhodes in 227/6 B.C., Hieron II, a tyrant of Syracuse, and Gelon donated 75 talents of silver, part immediately and part after a short interval, as well as silver cauldrons with supports, while each of the benefactors gave ten talents for offerings and aid for the citizens. Ptolemy III Euergetes promised to send the Rhodians among other things 300 talents of silver, 1000 talents of bronze coins and 3000 talents of bronze (?) for the restoration of the Colossus. Most of this, including one third of money, he gave immediately. Among the gifts of Antigonos Doson were 3000 talents of iron and 100 talents of silver; his wife Chriseis sent 3000 talents of lead.

Hellenistic monarchs usually carried enormous amounts of money in their baggage trains. We learn from Diodorus (XX.108.2) that Antigonos carried 3000 talents as an emergency fund. In the age of the Diadochoi, travelling war chests involved large sums: from 500 to 1000 talents (Diod. XVIII. 52.7; XIX.57.5; 61.5)[560].

Besides royal treasuries, sanctuaries could also perform the function of banks. The inviolability of sanctuaries protected valuable votive offerings. The sanctuary of Artemis at Ephesus is the most notable example of this function. Thanks to its inviolable status the Sacred Island of Delos became one of the most important trading centres of the Mediterranean[561]. But the growing practice of sacrilege from the 4th century B.C., particularly by the Aetolians and Cretans, caused the appearance by the middle of the 3rd century B.C. of decrees and treaties stipulating the sanctity of sacred areas. Besides, the Greeks would not have continued to dedicate the *dekate* from booty and other sums to sacred shrines, if they thought that these would be subject to seizure[562].

It is difficult to determine the proportions of metal objects offered as dedications at the temples and of those left in commercial circulation. Theoretically the proportion of votives should have been falling in the Hellenistic period. B.S. Ridgway has already stressed that this was the tendency with sculpture: whereas in the 5th and 4th centuries B.C. statues were mainly cast for cult purposes, later on they were primarily installed in private houses or in tombs and the greatest artistic creativity was expended in the production of luxury objects to provide the trappings of monar-

[560] W.K. Pritchett, 1991, 160.
[561] U. Sinn, 1993, 90-91.
[562] W.K. Pritchett, 1991, 161, 165.

chy[563]. E. Rice adds to this the public relations effect: it may have been felt that a maximum of useful propaganda could be obtained from the construction of high-profile civic structures or the staging of festivals[564].

Maintaining the difference between propagandistic monuments from the Classical and Hellenistic periods J. Pollitt held that although in the Classical period "portraits of generals were sometimes included in such creations, they were by and large impersonal monuments, emphasizing the events and the cities involved but placing little or no emphasis on specific personalities. By contrast, the major focus of much of the propagandistic art of the Hellenistic period was on the personality of the individual ruler who shaped events"[565]. E. Rice mentions that like all generalizations, Pollitt's observation is not completely true: the change from a stock 'civic strategos' figure to an instantly identifiable individual is one aspect of this trend; a change in the method of 'historical representation' is another. These changes are not, however, in his opinion progressively 'evolutionary' or universal[566].

A special form of honorary statue was the equestrian statue, and although it occurred earlier, in the Early Hellenistic period it became mainly the privilege of Hellenistic monarchs. It is worth noting that such statues were usually cast in bronze[567]. Indeed, the real picture appears to be more complicated. In a recent study of inscriptions from the bases of Hellenistic and Augustan statues from Kos, K. Hoghammar completed a list of 104 "statistical units". Of these, 43 are honorary in character and 30 belong to both the honorary and dedicatory categories. Twenty-five are dedicatory and six are of unknown character. Of the honorary statues, 41 depict human beings and only two a personification of the *Demos/Polis* of Kos and the *Demos* of Myndos. Of the honorary and dedicatory statues twenty-eight depict a human (in five cases the human is described as a god in the inscription), one a god, and one is of unknown character. Four dedicatory statues portray a human and one a human as a god, and 16 certainly or probably

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[563] B.S. Ridgway, 1990, 9, 373.

[564] E. Rice, 1993, 232f.

[565] J.J. Politt, 1987, 19.

[566] E. Rice, 1993, 225. See examples of erection of honorary statues and presentation of gold crowns by the cities after the epigraphical sources: P. Gauthier, 1985, 79-92.

[567] See about these statues: B. Hintzen-Bohlen, 1992, 68, 104-106, 120-121, 130, 140, 183-184, 200.

a god[568]. Of the twenty-five examples of dedicatory statues eleven come from the first third of the Hellenistic period, ca. 330 to ca. 210 B.C., which leads Höghammar to believe that dedicatory statues with inscribed bases were relatively commoner in the Early Hellenistic period than in later periods. However this observation is less significant to my study, and dedicatory statues were normally carved in marble. Much more peculiar is the fact that the chronological distribution of honorary statues, which were more often cast in bronze, reveals a link with the political situation. For example, of six honorary statues belonging to the years around 200 B.C. all but one can be traced back to the political turmoil and wars of the period. At the same time, there are only two or three honorary statues from period of ca. 190-150 B.C. This period saw immense programmes building and rebuilding in town of Kos. The large harbour sanctuary near to the agora was built at this time. K. Höghammar maintains that the remarkably small number of honorary statues in the first half of the 2nd century B.C. is due to the fact that at this time the Koan state did not need the help and donations of private citizens and settlers. It was rich and strong enough to fulfil its obligations to the population without outside help[569]. Public bodies and officials were the largest commissioners of statues on Kos: ca. 75% of the statues were ordered either by public bodies representing the citizens of Kos, public officials or rich private individuals. The cost of a statue was too high for the vast majority of individual members of the population to be able to afford to commission one. It is worth comparing this with the dedications of small votives in the Athenian Asklepeion mentioned above (only 2.1% of such dedications can be considered as official). Of the thirty statues commissioned by the *demos* on its own, twenty-eight depicted human beings[570]. Of the thirty statues commissioned by private persons eighteen are sculptures of humans and twelve statues of gods. There would thus appear to be a difference in the kinds of statue commissioned by the *demos* and the *demes* on the one hand and by private persons and public officials on the other. The public bodies usually ordered portrait statues, public officials mostly ordered images of gods, while private persons ordered both types, possibly in

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568 K. Höghammar, 1993, 59f.
569 K. Höghammar, 1993, 62-64.
570 K. Höghammar, 1993, 72f.

equal proportions[571]. Both Athens and Kos appear to have had only a small number of patrons from foreign states. Delos offers a completely different picture after 166 B.C.: perhaps as many as two-thirds of the statues erected on the island (including those depicting gods) were commissioned by non-Delians, either residents or visitors[572].

I have already argued for the considerable significance of dedications by Hellenistic kings at the leading Greek sanctuaries. The distribution of these dedications in the Hellenistic period provides a clearer reflection of their political importance. For instance, the Aetolian and Achaian Leagues made dedications mainly at Delphi, Philip of Macedon, Alexander the Great and the Antigonids, as well as the Attalids and the Seleucids usually offered votives on Delos, while the Ptolemies dedicated both at Olympia and on Delos[573]. This distribution is not identical to that of the honorary statues of Hellenistic rulers[574]. What is notable here are the shifts in the importance of various pan-Hellenic sanctuaries. Whereas in the 6th-4th centuries B.C. Delphi and Olympia were the most important sites for dedications, in the Hellenistic period Olympia was of less significance. Small and politically insignificant states continued to make their dedications at Olympia. However, Delos with its sanctuary of Apollo grew in importance being preferred due to its geographical position by various sovereigns. The great powers of the Hellenistic world dedicated mainly at Delphi and on Delos[575].

I have already argued that portraits of Hellenistic rulers were copied and distributed in different metals, including precious ones, in the form of statues, statuettes, rings, coins and even as furniture decorations[576]. This is a problem with several aspects: what degree of realism was there in the treatment of monarch's features in such portraits? Can we speak of officially organized propaganda, as in the Roman Empire, when the portraits of em-

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[571] K. Höghammar, 1993, 75-76.

[572] K. Höghammar, 1993, 74.

[573] B. Hintzen-Bohlen, 1992, 193.

[574] B. Hintzen-Bohlen, 1992, 194.

[575] B. Hintzen-Bohlen, 1992, 137, 205.

[576] See, e.g.: J.J. Politt, 1987, 19-46; R. Thomas, 1992, 122-128. As H.P. Laubscher (1991, 238) has recently suggested a bronze statuette of a rider from New York, representing Ptolemy II was a reproduction of a large-scale equestrian statue, which soon after its creature was probably replicated in small scale, being a form of publicity most probably initiated by a royal court.

perors—in more or less idealized forms depending from the artistic fashions of the time—were distributed to the provinces as official images of power? Is it possible to extrapolate this situation into the Hellenistic period when the institutions of the *poleis* stressed the democratic equality of citizens?[577]. B.S. Ridgway in discussing portraits attributed as those of Alexander the Great, says that if one accepts that all these images were of the same person, then accuracy of likeness could not have played a very significant role in the creation of such portraits. She analyzing the view expressed by Plutarch that Alexander was so fond of being portrayed by Lysippos that only he was allowed to make Alexander's portraits[578] and thinks that this is an interpretation of a later author, who saw it as quite logical that an artistic monopoly be granted in the context of Imperial propaganda campaigns[579].

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577 B.S. Ridgway, 1990, 109.

578 De Alexandri Magni Fortuna aut Virtute II.2.3; A.M. Nielsen, 1987.

579 B.S. Ridgway, 1990, 113.

# CONCLUSION

The Late Geometric—Archaic periods marked the embryonic stage in the establishment in Greece of mining and metalworking, which existed for several centuries afterwards in one form or other. Mining had a local focus and was based on domestic resources and seasonal manufacture, whereas the usual basis of metalworking was the small workshop. Such forms of production evolved by means of a division of labour and specialisation; this was less so in the case of mining, but was much more common in the case of metalworking. In tracing the course of evolution of metal extraction, metallurgy and metalworking in Greece over eight centuries, I have come to the conclusion that the principal models of mining came into being at a comparatively early date. Such types existed side by side in various forms both in the Classical and Hellenistic periods, the actual forms depending on the socio-economic and political structure of society as well as on the ethno-cultural characteristics of neighbouring peoples, who worked the metal deposits.

It is suggested that the Laurion mines may have achieved an output of 20 tons of silver per year in the 5th century B.C. The volume of metal production was growing, and probably reached a peak during the Hellenistic period especially once the Romans began active mining in the Iberian peninsula after the 2nd century B.C. when it should be estimated in terms of one hundred of tons or more annually. Metallurgical workshops were usually situated in close proximity to mines. Archaeological evidence for such workshops already dates back to the Archaic period and comes from regions as varied as Thessaly and Spain, suggesting that the refining of ore and extraction of metal were usually conducted in the mining regions themselves.

The same tendency said to be present in mining and metalworking is seen in an analysis of trade in metals. Different forms of this trade developed in parallel, in both the Archaic and the Hellenistic epochs. The predominance of a particular model was not chronologically determined, but depended rather on the influence of a specific political situation in a region on the establishment of trade links.

It seems to me that the principal form of trade in metals, at

least from the Archaic period, was the trade in ingots; these were usually transported as part of mixed cargoes, sometimes together with scrap metal. The trade in ore was probably less common, although there is some indirect evidence for trade in mineral ore from the 8th-7th centuries B.C. (the find of ore on Pithekoussai and the results of examination of 9th-7th century B.C. bronzes and slag suggest that tin in the form of cassiterite was used in refining copper). This evidence could suggest that in the 8th-7th century there was trade in ore and this might explain the total absence of underwater finds of ingots before 600 B.C. Later on, we have evidence of trade in litharge from the Hellenistic period. In some cases it seems that ships with consignments of metal carried craftsmen who undertook work at their ports of call and that this practice—which goes back to the Late Bronze Age—existed throughout the period studied. In one case (that of Sardinia) the underwater find of ingots of a copper-tin-lead alloy suggests that such alloys were produced not at metalworking shops, but in metallurgical workshops, which exported not metal ore or even unprocessed metals in ingots, but alloys which had already been prepared according to a given recipe. This fact presupposes at least stable relations between the metalprocessing areas of Sardinia and a particular overseas customer, who had probably ordered an alloy of the given specification. However, one cannot prove the existence of such stable relations between mining regions and metalworking centres in the pre-Hellenistic period.

The ancient trade in metals was influenced by political events, such as wars, changing spheres of influences, or trade treaties. For example, it was probably the destabilisation of the economy and trade relations as a result of the Peloponnesian War and its sequences both for the mining industry through a loss of manpower, which led also to the change in the trade routes, along which metals had previously been distributed. However by at least the mid-4th century B.C. shipwrecks with finds of metal ingots and bronze objects provide evidence for the establishment of an international trade network in metals and metal objects in the Mediterranean and Pontic basin. This was due to the intermediary activity not only of Greek, but also of Carthaginian, traders who long played key roles in sea trade in the Mediterranean basin. The find from Cabrera B seems to confirm the role of Punic merchants as traders in metals at least in the Western Mediterranean in as late as the third quarter of the 3rd century B.C., although the First

Punic War and its consequences brought about a redistribution of stocks of metal in the ancient world and, correspondingly, indirectly influenced a change in the composition of alloys. The Second Syrian War occurred at practically the same time (between 262 and 246 B.C.), and as a result Rhodes, as the most powerful sea state in the Eastern Mediterranean in the 3rd century B.C., rose against Ptolemaic Egypt and destabilised the trade in metals between the Western and Eastern Mediterranean.

Late Hellenistic wrecks with metal ingots have only been found in the Western Mediterranean. These wrecks contain lead ingots, usually as part of mixed consignments, and reflect the trade in lead between the Iberian mines and Italy via Gaul. Normally such lead cargoes did not comprise more than 1 ton of metal. In comparison to average cargoes, the cargo of the ship which sank at Agde G with about 100 tons of litharge is unusual. Perhaps, the most important feature is the start of really large-scale importing. According to dating evidence from the wrecks the beginning of this process should be placed in the late 2nd century B.C. It is to be associated with Roman exploitation of the silver mines of Spain at least from 179 B.C., originally possibly by individual contractors, later by companies of shareholders, *societates publicanorum.* Finds of stamped lead ingots from wrecks in Western Mediterranean date however mainly from the late 2nd and early 1st centuries.

The interruption of the trade links that supplied tin to the Eastern Mediterranean in the late first century and early second quarter of the 2nd century B.C. are reflected in changes in the metal composition of coins. This urgent need for metal was probably the reason for the other principal type of trade in metal in the Eastern Mediterranean in the Late Hellenistic era. There is no evidence for seaborne trade in ingots in this period in this part of the world: there was a wide-spread trade in scrap metal, primarily of fragments of bronze statues, which was already known in the Classical era, to judge by analysis of the Porticello finds. In some cases (Megadim and Mahdia) these two forms of trade in metal were combined. Finally it is obvious that the volume of seaborne trade in bronze objects grew in the Hellenistic epoch.

If one assumes that the trade in tin and probably in silver from the mines of Iberia was conducted in the Eastern Mediterranean and the Pontic region largely by the Rhodians, whose biggest trade partner in the West was Carthage, then in the course of the

first half of the 2nd century B.C. with the growth of Roman supremacy, the share of Rhodes in long-distance seaborne trade was falling. Critical moments were the Roman sanctions against Rhodes in 167 B.C.—which led both to a reduction of the Rhodian fleet and of the scale of trading—and the fall of Carthage in 146 B.C.

The price of any given metal would have been influenced by various factors linked both to its quality and relative accessibility and its cheapness; prices could however vary greatly because of a temporary shortage. In some cases, for instance in the Classical period, traders caused this intentionally.

The development of bronzecasting or toreutic centres was in no way determined by the existence of proprietary deposits of certain metals, but was the result of the internal socio-economic development of a society, which itself also depended on how the state was governed. Greek metalworking is characterised by faster evolutionary change than is the case with the development of mining and the trade in metals. This evolution was based on a division of labour and specialisation which led to mass serial manufacture and was primarily determined by the needs of the military and the mints: it was in these areas that large-scale workshops were first established. In other sectors small workshops predominated throughout the ancient period.

From the 8th century B.C. onwards, there is clear evidence that sanctuaries were becoming increasingly important centres of craft production, and especially of metalworking. By the mid-8th century B.C. each region of mainland Greece had its own bronze workshops, which were able to meet regional needs for adornments for clothing and ornaments, bronze statuettes and tools. They were dependent on the sanctuaries and sold the principal types of bronze figures to the big cities. On the other hand, the technically complicated manufacture of, for example, tripods and cauldrons with griffin protomes was probably limited to several centres of production, such as Argos, Corinth and Athens, and probably Phocis as well. Similarly, current scholarship shows that pieces of armour, particularly, early types of helmets, were practically only produced in two centres: Argos and Corinth. Thus the supply of armour to other Greek localities probably initially depended on the output of these two centres and on trade relations.

As A.M. Snodgrass has stated, metalworking in the 8th century B.C. was characterized by the use of large amounts of iron and

bronze, of modest amounts of gold and silver, and of very small quantities of lead. In my opinion, we should modify Snodgrass's conclusions to take account of the regional differences in the development of metalworking and the use of various materials and alloys, which existed in the 8th century B.C.

Snodgrass has linked the discontinuation of male burials with arms and of female burials with metal grave-goods in certain areas of Greece from ca. 700 B.C. with the "hoplite reform" and the rise of the polis and also maintained that this was associated with one more innovation, namely the sharp increase in dedications of exactly the same classes of objects at the sanctuaries—"the communal superseding the personal". However, analysis of all known cauldron protomes reveals not a decrease in their production, but, on the contrary, an increase between the second half of the 7th century and the first quarter of the 6th century B.C., although this growth in production is primarily associated with Samian workshops. A similar, if not even sharper, increase in manufacture is shown by analysis of the chronological distribution of other categories of bronze goods found at Olympia. The majority of finds is dated to between the second half of the 7th century and the 6th century B.C. But we should also consider the diversity of shapes of bronze vessels which was being established in the Early Archaic period, as is shown by finds from Olympia. These examples compel us to abandon a synonymous evaluation of trends in the development of Greek metalworking and stress once more the regional peculiarities of different centres. Furthermore, it does not seem possible to maintain that there was any sharp increase in for example the production of armour in the first half of the 7th century B.C. For instance, to judge by the chronological distribution of the greaves published by E. Kunze, the growth in their manufacture should be dated to the first third of the 6th century B.C.

Towns played a prominent role in technical and artistic developments in the Geometric period by establishing a metalworking infrastructure. Thus, at Olympia not only local craftsmen were working, but also those from the other regions of Peloponnese.

The isolation of metalworkers in the structure of early Greek settlements is proved by the district excavated at Pithekoussai, the inhabitants of which were engaged in the treatment of various metals. In the late 6th century B.C. a similar quarter existed in Pantikapaion. D. Ridgway has assumed that the peripheral location of the industrial complex at Mezzavia, which he has desig-

nated as "suburban", is precisely what we should expect, for early smiths needed to be near sources of the charcoal that they used in vast quantities, and their fellow citizens were doubtless anxious to avoid the risk of fires and the certainty of malodorous smoke in the main settlement. However, it is be doubted—especially in view of the practice which existed in the Classical period—whether restrictions on the siting of metalworkshops already existed in Late Geometric times. There is little to suggest any concentration of industrial activities in special districts before the late 6th century. There were perhaps different models for the grouping of metalworkshops in town structures. Observations of the organization of the manufacture of ceramics in Archaic and Classical Athens and Corinth show that they differed in details of manufacture, the location of workshops, and the pattern of distribution of finished objects. The Yagorlyk settlement, which may had been a seasonal camp for craftsmen from Berezan and was situated close to supplies of raw metal and fuel, is an example of a specialized craft settlement, where objects were manufactured of various metals and glass.

There are grounds to suggest that craft districts were established outside city walls only in the Classical period and that in these metalworking was sometimes associated with the production of pottery. For example, in the 4th century B.C. such districts appeared in Southern Italy. Later on, in the Hellenistic period it may be assumed that such metalworking districts existed in Memphis.

One can also assume that stable permanent workshops for the production of certain categories of bronze utensils existed in the 6th century B.C.: these were located in the main polis centres and were oriented towards stable patterns of consumption. Such stable stationary workshops, to judge by analysis of a cauldron with palmette attachments from Olympia, existed for longer than a single generation of craftsmen and guaranteed the continuity of craft tradition. W. Gauer maintains that besides cauldrons, other types of bronze utensils, like hydriai and mirrors, were manufactured in such workshops. At the same time, as in previous periods, temporary workshops existed which manufactured bronze vessels at the pan-Hellenic sanctuaries, and moved from sanctuary to sanctuary. Some of these workshops met the demand of the barbarian hinterland, moving, for example from Laconia to Lydia, from here to Italy and so on.

Constructions with the remains of metalworking workshops, dating to the 8th-6th centuries B.C. and unearthed at Pithekoussai, Corinth, and Pantikapaion, reveal an undifferentiated character of production and those workshops which were probably specialized, for example in the manufacture of armour, were usually small, occupying houses of 1-2 rooms. An exchange of tools, such as matrices, or a "technological transfer" between different workshops, manufacturing, say, tripods or mirrors, or small figurines, was not impossible in the Geometric period given its undeveloped division of labour. In the Late Geometric period it is perhaps possible to see the beginnings of such specialization. The start of further specialization in the manufacture, for instance, of arms and armour was laid in the Archaic period, when craftsmen appeared, who specialized in the production of helmets (*kranopoioi*), cuirasses (*thorakopoioi*), shields (*aspidopegoi*), swords (*xiphopoioi* and *macheiropoioi*), and spears (*lonchopoioi*). Although these names for professions were only established in the Classical period, the process of specialization had undoubtedly already begun in the previous epoch, during the last third of the 7th century B.C. In the 6th century B.C. there appeared temporary workshops such as the casting pits, normally used for the casting of a single sculpture, known from Athens and Corinth. There are reasons for suggesting that in the 5th century B.C. at least some of workshops, in which such large-scale sculptures were cast, were built with the aim of using them on a permanent basis. However, the process of specialization in metalworking could not make much headway during the Archaic period. A tradition, preserved by ancient writers, describes the craftsmen of the 6th century B.C. as versatile masters, often working simultaneously as architects, bronze founders, toreuts etc. If Telesstas, whose name is inscribed on the rim of a bronze hydria of the first quarter of the 6th century, and a bronze sculptor of the same name, who made a bronze statue of Zeus for the people of Kleitor in Arcadia, dedicated to Zeus at Olympia and mentioned by Pausanius (V. 23.7) are the same person, as some scholars have suggested, then we have a rare example of a correlation between archaeological data and literary tradition.

The practice of manufacturing fairly accurate reproductions became wide-spread in the 4th century B.C. both in bronze sculpture and toreutics. The following observations are worth considering: the use of matrices in the manufacture of series of articles

presupposed firstly the production of details of arms, secondly the use of precious metals, thirdly some special purpose for such series of articles: either for the decoration of cuirasses, or, as is quite probable, as diplomatic gifts. In both cases, however, it is quite possible that the matrices were in use in royal workshops. The technique for producing exact reproductions by means of indirect casting, which developed in the Hellenistic period, was directly associated with the growing popularity of reproductions of Greek originals.

Rather recently a hypothesis has been put forward that already in the Late Archaic—Early Classic period a system for the division of labour between workshops in different centres began to take shape, even if in an embryonic form. To my mind, the system of letter marking of separate parts of large vessels was rather a reflection of the division of labour within a single workshop.

There was surely some division of labour between the work of a sculptor and that of a founder in the 3rd century B.C. This is shown by the inscriptions on the bases of statues from Rhodes. The same sculpture was sometimes created by masters from various centres: for example, Chios and Ephesus, Rhodes and Kos, Antioch and Rhodes etc., usually not very distant from each other.

The increase of serial production in Hellenistic metalworking and thus the further division of labour within workshops is shown by the casting of separate details—arms, legs, drapery—of bronze statuettes: these may have later been joined to the figures of different deities. This technique, which was especially common in the Roman Empire, was originally used in the Late Hellenistic period in the most advanced art centres: in Southern Italy and Ptolemaic Egypt.

The growth of specialization led to a tendency which was carried further later on under the Roman Empire. Craftsmen from various professions, including smiths and armourers, were already entering into professional partnerships in the Hellenistic era, to judge for example by inscriptions of the 1st century B.C. from Argos and Sidon. This was probably connected with the evolution of a professional self-awareness among Hellenistic craftsmen. Like the scenes with workshops on 6th-5th centuries B.C. vases, images of armourers making helmets, shields or bronze objects were very common in the 2nd-1st centuries B.C..

It was most probably already in the Late Geometric period that independent wandering craftsmen opened workshops, producing

votives at the prominent sanctuaries. There are grounds for suggesting that wandering Laconian metal-smiths were at work at Olympia. The possibility cannot be excluded that bronze founders from Corinth and Sparta worked in the Samian Heraion as well as at Olympia.

Besides wandering sculptors and founders there were also itinerant workshops of toreuts in the 6th century B.C. , which manufactured richly decorated articles of bronze. W. Gauer calls these workshops the "*wandernde Elite*", assuming that they were to certain extent pan-Hellenic and suggesting that on occasions craftsmen of different origins worked together in such workshops. However, these wandering workshops did not drop their links with their mother cities, even when they were looking for other permanent places to work. Wandering workshops were, in Gauer's opinion, established not only at Greek sanctuaries. It is said that they also met the demand of the barbarian hinterland for Greek luxury bronze vessels, like those found in Celtic, Thracian and Scythian tumuli.

In the 4th century B.C. the number of wandering craftsmen was growing. It is evident that this was less true of smiths, who usually had fixed workshops to meet the needs of a given centre. However craftsmen who worked in precious materials or with unusual techniques had from time to time to solve the problem of how to find work. What factors influenced mass migrations of metalworkers?

1) Wars, the devastation of cities, and economic decline as a result of these.

2) Programmes of sudden and mass ship construction and the manufacture of arms and cuirasses.

3) The enlistment of craftsmen and artists including metalworkers and sculptors and correspondingly the process of setting up temporary workshops were certainly influenced by public building programmes.

4) Orders placed by temples. Craftsmen who produced precious vessels for temple treasuries could be also invited to work on-site.

The disintegration of the Persian Kingdom after its conquest by Alexander led to the mass unemployment of numerous craftsmen, toreuts, jewellers etc. In connection with the grandiose plans of Alexander and the Diadoches, city building programmes reached an enormous scale in the Early Hellenistic epoch, and es-

pecially in the East attracted mainly wandering craftsmen. With the establishment of independent states in the eastern regions of former Empire of Alexander the Great, workshops for toreutics and metalworki... ; were established in their capitals and other significant centres. Alongside local masters Greek craftsmen worked there, especially in the initial stages of city development. Greek sculptors and founders also worked at the courts of barbarian kings and for their temples.

In the Classical period private metalworking shops were associated with the establishment of large state workshops, mainly for the production of arms. There is no evidence of how the system worked. However it can be assumed that it combined the fulfilment of orders by large private workshops with the organization of state ergasteries. If arms and armour for hoplites could have been produced in various private workshops, then the task of constructing and equipping fleets was much more difficult and complicated—large amounts of metal were need for the casting of the metal parts of war ships, particularly rams, and this led to the appearance of metalworkshops in docks. The practice establishing large ergasteria went hand by hand with the practice of state redistribution of arms and armour from the arsenals. It seems evident that this could not have been common much before the first decades of the 4th century B.C. and not in every region. Sparta may have pioneered such a system; after Sparta, the system of state supply of the army was widely used by Dionysius and then by Athens. It seems clear also that the development of the state system of armories was stimulated by the employment of mercenary soldiers in the 4th century B.C., the further professionalization of warfare, and the creation of ever more specialized troops.

The main stimulus for the development of state armories in Sicily was the specific situation here: the new state institution was not only the result of need to fight a global war, the conquest of an enemy's territory and enslavement of a foreign population, but also the group reaction of the Greek cities to an external danger—the onslaught of Carthage. In the mid-4th century B.C. the system was adopted by Philip of Macedon.

I think that the practice of state distribution of weapons was a predecessor of that type of redistribution of metal objects found in the Hellenistic monarchies.

The development of monetary courts ran to some extent parallel to the system of state or poleis armories. They ran parallel pri-

marily in the sense that during the preparation and in the course of military campaigns, especially with the growth in the employment of mercenary soldiers, there was a growing need for coinage and thus for corresponding amounts of metal, unless some extraordinary arrangements could be made.

Thus, it is possible to maintain that in line with the importance attached by the Greek states to the accumulation of stocks of precious metals and with improvements in military technology, policy towards mining and metalworking changed: from private initiative in the 8th century towards complicated systems of state control in the Hellenistic kingdoms. The pattern of distribution of metals changed as well: from offerings of most metal production as votives in temples and sanctuaries to the amassing of enormous amounts of royal treasure, from dedications to deities to the private savings.

The problem of the reasons for and character of the Greek colonization is an object of never-ending discussions. In recent decades more and more attention has been paid to the problem of the search for raw materials, primarily metals, as a motive for colonization, and the important role of search for metals as a reason for colonization has been considered by many scholars. However, the only credible archaeological argument given by adherents of the "metallic" colonization theory is the existence of Greek imports in the metalbearing regions. However, as is known, the very fact of imports does not always prove the existence of trade relations. Besides it is necessary to stress that the increased importance of metalworking in Geometric Greece started at least half a century before the establishment of the first colonies. However paradoxical it may seem, there is no reason to assume any increase in the role of metalworking in the economies of the early city-states: growth was primarily in the production of votive utensils and statuettes for the sanctuaries. There is no doubt that Near Eastern metal-smiths and toreuts had already established their workshops in different areas of Greece in the 9th-8th centuries B.C.; some of them indeed left an obvious influence on the development of local metalworking, establishing metalworking schools with Greek apprentices and pupils and asistants of mixed marriages. They also introduced into Greece more advanced techniques for metalcasting and the use, for instance, of high-tin bronze technology. Phoenician traders maintained trade in metals in the Mediterranean basin. Thus, we have a picture of Syro-

Phoenician domination both in the distribution of crude metal and in metalworking technology in the Eastern Mediterranean. However, they never possessed a monopoly, while the Greeks did themselves occasionally undertaken voyages, like those to Temessus described in the Odyssey.

There seems to be some truth in the view that in founding colonies the primary consideration was the degree to which the site chosen satisfied the the needs of its inhabitants, i.e. of the migrants, rather than of the mother city. Finally, although the Greeks imported metals, and did so via their colonies, this does not at all mean that the colonies were founded to afford such imports. Moreover, it is necessary to remember that apart from well-known factors such as overpopulation and a lack of land, other reasons, which can hardly be detected in the preserved sources, may have influenced Greek colonization, such as droughts and other climatic disasters. Furthermore, one should remember external factors, such as Persian pressure, the destabilisation of the Lydian Kingdom etc. Thus, one should not mix up or seek to find any interdependency between trade in metals and the colonization movement.

Some scholars, who have analyzed jewelry art of the 6th century B.C., have argued that there was a considerable reduction of objects, dating from that period in comparison to the previous one. They come to the conclusion that gold mining ceased in this epoch. I think that some of the reduction of jewelry manufacture can be explained by Greek frugality, reflected in the reforms of Solon, that limited luxury, and the activity of the legendary Spartan law-giver, Lycurgus, who outlawed all useless art. A good example of self-restraint is provided by Herodotus (I.82.7) who tells that the Argive women stopped wearing gold after the Battle of the Champions, probably in the 540s B.C. While jewelry of the 7th century B.C. originates from mainland Greece, the Greek islands and Ephesus, the majority of the 6th century objects were found in Macedonia (primarily, the necropolis of Sindos), Thrace and the Islands. Thus, it is quite probable that the reduction in the output of gold objects in Greece and the attraction of craftsmen to the periphery, where rich customers existed among the nobilities of Scythia, Thrace, Southern Italy, and Gaul, is best explained by such reforms and not by shortages of Greek supplies of gold. The process led to the formation of the so-called Greco-Scythian, Greco-Illyrian, Greco-Celtic, and Greco-Etruscan styles in jewelry.

The fall of Lydian kingdom in 546 B.C. and the conquest of the Greek cities of Ionia by Cyrus was behind the forced emigration of Ionian craftsmen, including sculptors, bronzeworkers and toreuts to other Greek centres, but also to the periphery of the Classical world, for example in the context of the "second wave" of the Greek colonization of the Northern Pontic area. If one adopts the hypothesis recently put forward by W. Gauer, the conquest of the Lydian kingdom may have forced the Laconian craftsmen temporarily working for Croesus to seek new markets and thus have led to the establishment of workshops in Magna Graecia, including the one in which the Vix krater was manufactured. The suggestion that Laconian craftsmen migrated to Italy in the mid-6th century B.C. is confirmed by B. Shefton's analysis of a type of Etruscan bronze oinochoai, the so-called Recanati Group.

In the middle to the third quarter of the 6th century B.C. the activity of some Greek tyrants contained elements of an economic policy or at least some of their measures brought about obvious economic effects. The desire of the Greek tyrants to possess objects in precious metals led to military conflict, which, correspondingly, demanded the manufacture of arms and armour and led, perhaps, to a tendency to control the distribution of metals. To my mind, this is also proved by the dynamics of production and development of the manufacturing technology of bronze articles, particularly of armour.

The devastation of Attica by the Persians in 480 B.C. and thirty years of decline of the mining industry (at that time the output of Athenian coinage was sharply reduced) are, in my opinion, reflected in Athenian foreign policy. At the very same time Athens once more revealed ambitions to control the region of the Pangaeus mines in Thrace.

The example of the Athenian colonization of Pangaeus region and of her economic claims to Thasos, which lead to the war mentioned above are rare episodes in which state ambitions to control deposits of precious metals and other natural resources, led with strategic factors to war. After the 470s B.C. Eastern Macedonia became a centre of attraction not only for Thasos and Athens, but also for the Macedonian Kingdom. One could suppose that such tendencies, rare in the previous epoch, became more common in the Early Classical period, although they did not lead to any prevalence of "trade wars". As at Athens there was a significant develop-

ment in the Classical epoch of metalworking in Sicily and Southern Italy. It was to a certain extent connected with the policy of Syracusan tyrants, starting with Gelon, who probably established control over the tin mines of Iberia (?) and the distribution of that metal. As in Magna Graecia in the second half of the 5th century B.C. small bronze coins began to be struck, which brought considerable benefits to the state. Finally, measures of Dionysius such as the organization of the centralized manufacture of weapons for the army and the wide-scale development of artillery, caused an accelerated development of metallurgy and metalworking. To create such mass supplies of weapons it was necessary to accumulate significant supplies both of bronze and iron and of the precious metals, necessary for coinage. The same design lay behind a levy, the *eisphora*, which was introduced by Dionysius in wartime. An extremely active monetary policy was conducted by means of issuing various values both of gold, silver and bronze coins with a tendency for large values to predominate. The use of weapons which were modern for that time brought a successful conclusion to the wars and brought Dionysius enormous profits both in terms of spoils of war, the proceeds of robbing temple treasuries and silver received for the ransom of captives.

The fact that in course of the 5th-4th centuries B.C. Greek states had showed a growing interest in controlling the use of metal supplies is proved by an inscription from the mid-4th century B.C. from Eleusis and a stele describing a so-called Monetary Union between Mytilene and Phocaea.

Finally, the development of toreutic centres was influenced by court needs. For example, Tarentum, a city with an oligarchic rule and oriented in its contacts towards the monarchies of Epirus and Macedonia, became a city that set fashions in the Greek world. I should mention that the growth of metalworking in Sicily and in the south of Italy took place in the absence of a local metallurgical base.

Another example of an increase in state power due to the exploitation of gold mines is Macedonia under the rule of Philip II. As has been noticed by M. Austin, "successful warfare in the world of the fourth century needed financial resources, as all Greek states found out, and that was something the Macedonians did already possess at home in the shape of their mines".

In the Hellenistic period there was a close interaction between the Greek and Roman worlds. It is suggested that from the second

half of the second century B.C. the relationship between Rome and the Hellenistic world took the form of a centre-periphery, with Rome as the centre-nation and the Hellenistic world as the periphery.

A significant episode is the closing of the Macedonian gold and silver mines after the defeat of Macedonia in the Third Macedonian War against Rome. Some scholars have suggested that the Macedonian mines had become the property of the Roman Republic. They were closed because the growth of metal extraction led to their depreciation and inflation. It is supposed that Rome started ruthless exploitation of Macedonian natural resources however an important factor, in my opinion, is that the Romans allowed further exploitation of the iron and copper mines in 167 B.C. (Livy. XLV. 29.11). Concerning the reasons for the closure of gold and silver mines I would rather agree with J.S. Richardson, who maintained that this act was rather connected with Roman fears about the possible political consequences of leaving control of the mines in the hands of the Macedonians.

In all the periods discussed we find traces of the presence of Eastern metalworkers in Greek workshops. While in the Geometric and Early Archaic period the evidence is abundant, it also exists for the Classical (e.g. the skilled workmen from the Carthaginian territory employed by Dionysius in 399 B.C.) and Hellenistic periods (a late 4th-century inscription from Kos). However, the contacts between Greek metalworkers and those of the cultures of Asia Minor and the Near East and later on the so-called "barbarian" communities, like the Celts, Scythians, or Sarmatians were bilateral and there are grounds to suggest that Greek toreuts already worked both for the powerful Lydian king Croesus and the Scythians in the mid- 6th century B.C. Later on Greek metalworkers may have been employed at the court and satrapal workshops of the Achaemenid Empire. From the other side we have evidence of the penetration of Celtic motifs into the artistic repertory of the Bosporan Kingdom in the 4th century B.C. and one can not rule out the possibility that Celtic metalworkers worked in the Mediterranean and Pontic basins. In the Hellenistic period remarkable metalworking schools emerged on the periphery of the Greek world, combining styles and techniques borrowed from Greek Hellenistic, Near Eastern and even Central Asian art. I suppose that in these workshops local craftsmen were sometimes employed alongside craftsmen of Greek or

Hellenized origin and in this way such heterogenous motifs and techniques penetrated into the art and crafts even of nomadic tribes, like the Sarmatians. The permanent importance of Greek metalwork, which was originally stimulated from the East, lies in its creation of fabulous masterpieces of art and artistic craft, and in the influence which it exerted on the development of the cultures and techniques of neighbouring peoples.

APPENDIX I

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APPENDIX II

# LIST OF ABBREVIATIONS

| | |
|---|---|
| AA | Archäologischer Anzeiger |
| AAA | Arxaiologika analekta ex Atenon |
| ActaArch | Acta Archaeologica, København |
| ActaArchHung | Acta Archaeologica Academiae Scientiarum Hungaricae |
| ActaPhHistA | Acta Praehistorica et Archaeologica |
| ADeltion | Arxaiologikon Deltion |
| AEphem | Arxaiologike Ephemeris |
| AF | Archäologische Forschungen |
| AJA | American Journal of Archaeology |
| AKorrBl | Archäologisches Korrespondenzblatt |
| AM | Mitteilungen des Deutschen Archaologischen Instituts, Athenische Abteilung |
| AMI | Archäologisch Mitteilungen aus Iran |
| AnatSt | Anatolian Studies |
| AnsSoc | Ancient Society |
| AncWorld | The Ancient World |
| ANews | Archaeological News |
| AnnEconSocCiv | Annales. Economies, sociétés, civilisations |
| AnnPisa | Annali della Scuola normale superiore di Pisa |
| ANRW | Aufstieg und Niedergang der römischen Welt |
| ANSMN | American Numismatic Society. Museum Notes |
| AntK | Antike Kunst |
| AntP | Antike Plastik |
| Antike Helme, 1988 | Antike Helme. Sammlung Lipperheide und andere Bestände des Antikenmuseums Berlin (Mainz)—(Römisch-Germanisches Zentralmuseum Mainz, Monograhien; 14) |
| Antike Thasos, 1988 | Antike Edel- und Buntmetallgewinnung auf Thasos, hrsg. G.A. Wagner, G. Weisgerber (Bochum)—(Der Anschnitt; Beih. 6) |
| AO | Arkheologicheskie otkrytiya=Archaeological Discoveries |
| ARepLondon | Archaeological Reports |
| ArtAs | Artibus Asiae |
| ASbor | Arkheologicheskij Sbornik. Gosudarstvennyj Ermitazh= Collection of Archaeological Articles. The State Hermitage |
| AuA | Antike und Abendland |
| AW | Antike Welt |
| BABesch | Bulletin Antieke Beschaving |
| BASOR | Bulletin of the American School of Oriental Research |
| BAR | British Archaeological Reports |
| BCH | Bulletin de correspondance hellénique |
| BClevMus | The Bulletin of the Cleveland Museum of Art |
| BdA | Bolletino d'arte |
| BdArch | Bolletino d'archeologia |

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|---|---|
| BEFAR | Bibliothèque des Écoles Françaises d'Athènes et de Rome |
| BEpigr | Bulletin epigraphique |
| BerlBeitrArchäom | Berliner Beiträge zur Archäometrie |
| BHMS | Bulletin of Historical Metallurgy Society |
| BICS | University of London. Institute of Classical Studies. Bulletin |
| BJb | Bonner Jahrbücher |
| BMetalsMus | Bulletin. The Metals Museum |
| BMetrMus | Bulletin. The Metropolitan Museum of Art |
| Bronzes hellénistiques et romains, 1979 | Bronzes hellénistiques et romains: Tradition et renouveau. Actes du Ve Colloque intern. sur les bronzes antiques, Lausanne, 8-13 mai 1978 (Lausanne)—(Cahiers d'archéologie Romande; 17) |
| Bronzeworking Centres, 1988 | Bronzeworking Centres of Western Asia c.1000-539 B.C. (London) |
| BSA | The Annual of the British School at Athens |
| BWPr | Winckelmannsprogramm der Archäologischen Gesellschaft zu Berlin |
| CAH | Cambridge Ancient History |
| ClQ | Classical Quaterly |
| Comptes et inventaires, 1988 | Comptes et inventaires dans la cité grecque. Actes du Colloque intern.d'épigraphie tenu à Neuchâtel du 23 au 26 septembre 1986 en l'honneur de Jacques Tréheux. I (Neuchâtel; Genève).—(Université de Neuchâtel, Recueil de Travaux publiés par la Faculté des Lettres; 40) |
| CRAI | Comptes rendus des séances de l'Académie des inscriptions et belles-lettres |
| DAI | Deutsches Archäologisches Institut |
| DialHistAnc | Dialogues d'histoire ancienne |
| Due Bronzi da Riace, 1985 | Due Bronzi da Riace. Rinvimento, restauro, analisi ed ipotesi di interpretazione. I-II (Roma)—(BdA, ser. speciale; 3) |
| Early Metallurgy, 1982 | Early Metallurgy in Cyprus, 4000-500 B.C., ed. J.D. Muhly, R. Maddin, V.Karageorghis (Nicosia) |
| Economics of Cult, 1992 | Economics of Cult in the Ancient Greek World. Proceedings of the Uppsala Symposium 1990, ed. T. Linders and B. Alroth (Boreas, 21) (Uppsala) |
| EmiliaPrRom | Emilia preromana |
| EPRO | Études préliminaires aux religions orientales dans l'empire romain |
| Études sur l'orfèvrerie antique, 1980 | Études sur l'orfèvrerie antique. Studies in Ancient Jewelry, ed. T. Hackens (Louvain-la-Neuve)— (Publ. d'histoire de l'art et d'archéologie de l'Univ. catholique de Louvain, XIV; Aurifex 1). |
| FdD | Fouilles de Delphes |
| FGrH | F. Jacoby. Die Fragmente der griechischen Historiker |
| FuB | Funde und Berichte. Staatliche Museen zu Berlin |
| GaR | Greece and Rome |

| | |
|---|---|
| Grecs et Ibères, 1989 | Grecs et Ibères au IV siècle avant Jésus-Christ, 1989. Commerce et Iconographie. Actes de la Table ronde, Bordeaux III, 1986, ed. P. Rouillard, M.-C. Villanueva-Puig (Paris)—(Publ. du Centre Pierre Paris, 19; REA LXXXIX, 3-4 1987) |
| Greece between East and West,1992 | Greece between East and West: 10th- 8th Centuries B.C. Papers of the Meeting at the Institute of Fine Arts, New York University, March 15-16th, 1990 , ed. by G. Kopcke and I. Tokumaru (Mainz) |
| Greek Colonists and Native Populations, 1990 | Greek Colonists and Native Populations. Proceedings of the First Australian Congress of Classical Archaeology, ed. by J.-P. Descoeudres (Canberra; Sydney) |
| The Greek Renaissance, 1983 | The Greek Renaissance of the Eighth Century B.C.: Tradition and Innovation. Proceedings of the Second Intern. Symposium at the Swedish Institute in Athens,1-5 June 1981, ed. R. Hägg (Stockholm) |
| Greek Sanctuaries,1993 | Greek Sanctuaries. New Approaches, ed. by N. Marinatos and R. Hägg (London; New York) |
| Griechische und römische Statuetten, 1988 | Griechische und römische Statuetten und Grossbronzen: Akten der 9. Tagung über antike Bronzen, Wien 21.-25.April 1986, hrsg. K.Gschwantler, A. Bernhard-Walcher (Wien) |
| GrRomByzSt | Greek, Roman and Byzantine Studies |
| HambBeitrA | Hamburger Beiträge zur Archäologie |
| HarvSt | Harvard Studies in Classical Philology |
| HelvA | Helvetia archaeologica |
| Hoplites, 1991 | Hoplites: The Classical Greek Battle Experience , ed. by V.D. Hanson (London; New York) |
| IAK | Izvestiya arkheologicheskoj komissii=Reports of Archaeological Comission (St.Peterbourg) |
| IAMS | Institute of Archaeo-Metallurgical Studies |
| IG | Inscriptiones Grecae |
| IOSPE | B. Latyschev, 1885-1916. Inscriptiones antiquae orae septentrionalis Ponti Euxini (Petropolis) |
| IntJNautA | International Journal of Nautical Archaeology and Underwater Exploration |
| IsrExplJ | Israel Exploration Journal |
| IstForsch | Istanbuler Forschungen |
| IstMitt | Istanbuler Mitteilungen |
| Italy before the Romans, 1979 | Italy before the Romans. The Iron Age, Orientalizing and Etruscan Periods, ed. D. Ridgway (London) |
| JAScien | Journal of Archaeological Science |
| JbBerlMus | Jahrbuch der Berliner Museen |
| JbBernHistMus | Jahrbuch des Bernischen historischen Museums |
| JbStiftPreussKulBes | Jahrbuch (der Stiftung) preussischer Kulturbesitz |
| JbZMusMainz | Jahrbuch des Römisch-Germanischen Zentralmuseums, Mainz |
| JdI | Jahrbuch des Deutschen Archäologischen Instituts |

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|---|---|
| JEA | Journal of Egyptian Archaeology |
| JFieldA | Journal of Field Archaeology |
| JHMS | Journal of Historical Metallurgy Society |
| JHS | Journal of Hellenic Studies |
| JMA | Journal of Mediterranean Archaeology |
| JNES | Journal of Near Eastern Studies |
| JNG | Jahrbuch für Numismatik und Geldgeschichte |
| JRSA | Journal of Royal Society of Arts |
| JSav | Journal des savants |
| JWalt | The Journal of the Walters Art Gallery |
| KölnJbVFrühGesch | Kölner Jahrbuch für Vor-und Frühgeschichte |
| KSIA | Kratkie soobshcheniya Instituta arkheologii AN SSSR = Brief Reports of the Institute of Archaeology, USSR Academy of Sciences |
| MASCA | Museum Applied Science Center for Archaeology, University of Pennsylvania |
| MarbWPr | Marburger Winckelmann-Programm |
| Marseiile grecque et la Gaule, 1992 | Marseille grecque et la Gaule. Actes du Colloque international d'histoire et d'archéologie du Ve Congrés archéologique de Gaule méridionale, Marseille 18-23 nov. 1990, ed. M.Bats (Lattes)—(Études massalietes; 3) |
| MB | Madrider Beiträge |
| MededRom | Mededelingen van het Nederlands Historisch Instituut te Rom |
| MEFRA | Mélanges de l'Ecole française de Rome, Antiquité |
| MIA | Materialy i issledovaniya po arkheologii SSSR = Materials and Investigations of the Archaeology of the USSR |
| MüJb | Münchner Jahrbuch der bildenden Kunst |
| MünstBeitr | Münstersche Beiträge zur Antiken Handelsgeschichte |
| Navies and Commerce, 1988 | Navies and Commerce of the Greeks, the Carthaginians and the Etruscans in the Tyrrhenian Sea. Proceedings of the European Symposium held at Ravello, January 1987, ed. by T. Hackens (Strasbourg)—(PACT; 20) |
| NumChron | Numismatic Chronicle |
| NumNachrBl | Numismatische Nachrichtenblatt |
| OF | Olympische Forschungen |
| ÖJh | Jahreshefte des Österreichischen archäologischen Instituts in Wien |
| Olympiabericht | Bericht über die Ausgrabungen in Olympia |
| OpAth | Opuscula atheniensia |
| OpRom | Opuscula romana |
| OxfJA | Oxford Journal of Archaeology |
| PACT | Revue du Groupe européen d'études pour les techniques physiques, chimiques et mathematiques appliquées à l'archéologie |
| Paleométallurgie de la France, 1984 | Paleométallurgie de la France atlantique. Age du Bronze, ed. J. Briard (Rennes) |
| PBF | Prähistorische Bronzefunde |
| PF | Pergamenische Forschungen |

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|---|---|
| Pots and Pans, 1986 | Pots & Pans. A Colloquium on Precious Metals and Ceramics in the Muslim, Chinese and Graeco-Roman Worlds, Oxford 1985, ed. M. Vickers (Oxford).—(Studies in Islamic Art; 3) |
| PP | La parola del passato |
| RA | Revue archéologique |
| RAssyr | Revue d'assyriologie et d'archéologie orientale |
| RdA | Rivista di archeologia |
| REA | Revue des études anciennes |
| RevNum | Revue numismatique |
| RM | Mitteilungen des Deutschen Archäologischen Instituts, Römische Abteilung |
| The Rogozen Treasure, 1989 | The Rogozen Treasure. Papers of the Anglo-Bulgarian Conference, 12 March 1987, ed. B.F. Cook (London) |
| SchwMbll | Schweizer Münzblätter |
| SicA | Sicilia Archeologica |
| SciAmer | Scientific American |
| SOsl | Symbolae osloenses |
| SovArch | Sovetskaya arkheologiya = Soviet Archaeology |
| StAltägKul | Studien zur altägyptischen Kultur |
| StEtr | Studi etruschi |
| Thorikos and the Laurion, 1975 | Thorikos and the Laurion in Archaic and Classical Times. Papers and Contributions of the Colloquium held in March, 1973, at the State University of Ghent, ed. H. Mussche, P. Spitaels, F. Goemaaere-De Poerck (Ghent)—(Miscellanea Graeca; 1) |
| TrudyErmit | Trudy Ermitazha=Proceedings of the State Hermitage |
| Tskhaltubo-I, 1979 | Problemy grecheskoj kolonizatsii Severnogo i Vostochnogo Prichernomor'ya. Materialy I Vsesoyuznogo simpoziuma po drevnej istorii Prichernomor'ya = Problems of the Greek Colonization of the Nothern and Eastern Black Sea Area. Materials of the 1st All-Union Symposium dedicated to the Problems of the Ancient History of the Black Sea Littoral, Tskhaltubo, 1977, ed. O.D.Lordkipanidze (Tbilisi) |
| Tskhaltubo-II, 1981 | Demograficheskaya situatsiya v Prichernomor'e v period Velikoj Grecheskoj kolonizatsii. Materialy II Vsesoyuznogo simpoziuma po drevnej istorii Prichernomor'ya = Demographic Situation in the Black Sea Littoral in the Period of Great Greek Colonization. Materials of the IInd All-Union Symposium dedicated to the Problems of the Ancient History of the Black Sea Littoral, Tskhaltubo, 1979, ed. O.D. Lordkipanidze (Tbilisi) |
| Tskhaltubo-III,1985 | Prichernomor'e v epokhu ellinisma. Materialy III Vsesoyznogo simpoziuma po drevnej istorii Prichernomor'ya = Hellenism and the Black Sea Littoral. Materials of the 3d All-Union Symposium dedicated to the Problems of the Ancient History of the Black Sea Littoral, Tskhaltubo, 1982, ed. O.D. Lordkipanidze (Tbilisi) |
| Tskhaltubo-IV,1988 | Mestnye etno-politicheskie objedineniya Prichernomor'ya v VII-IV vv. do n.e. Materialy IV Vsesoyuznogo |

| | |
|---|---|
| | simpoziuma po drevnej istorii Prichernomor'ya = Local Ethno-Political Entities of the Black Sea Area in the 7th-4th Centuries B.C. Materials of the 4th All-Union Symposium dedicated to the Problems of the Ancient History of the Black Sea Littoral, Tskhaltubo-Vani, 1985, ed. O.D. Lordkipanidze (Tbilisi). |
| VestDrevIst | Vestnik Drevnej Istorii=Journal of Ancient History |
| War and Society, 1993 | War and Society in the Greek World, ed. by J. Rich and G. Shipley (London; New York) |
| WorldA | World Archaeology |
| WürzbJb | Würzburger Jahrbücher für die Altertumswissenschaft |
| ZPE | Zeitschrift für Papyrologie und Epigraphik |

APPENDIX III

# LIST OF ILLUSTRATIONS

Fig. 1. Lead, Silver, Gold and Copper deposits in the Aegean in the Bronze Age and Antiquity (after E. Pernicka, 1987, 679, Abb. 28).
Fig. 2. Gold and Lead Deposits in the Aegean: 1—gold deposits; 2—lead deposits (after E. Pernicka, 1987, 622, Abb. 7; 621, Abb. 6).
Fig. 3, 1. Copper deposits in the Aegean (after E. Pernicka, 1987, 620, Abb. 5).
Fig. 3, 2. Scheme of the Eastern Mediterranean showing copper deposits, exploited in the Late Bronze Age, and routes for the transport of ingots (after N.H. Gale, 1989, 266, fig. 29).
Fig. 4. Map of Laurion with places in which ore was mined and washed (after G. Heinrich, 1986, Taf. I).
Fig. 5. Diagram of the Thasian mines (after A. Müller, 1979, 343, fig. 24).
Fig. 6. Schematic plan of the mine under Acropolis of Thasos (after A. Müller, 1979, fig. 3).
Fig. 7. Sites associated with metallurgical activity in the region of ancient Maryon on Cyprus (after P. Raber, 1987, 300, fig. 2; 306-307, figs. 3-4).
Fig. 8. Plan of the metalworkshop of the 7th century B.C. in Corinth (after Ch.K. II. Williams, J.E. Fisher, 1971, figs. 1-3).
Fig. 9. Plan of the 6th century B.C. casting pit at Heraion on Samos with the location of the Brychon votive find (after G. Schmidt, 1972, Abb. 1-5).
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Fig. 11. Maps of the distribution of Geometric pendants (after I. Kilian-Dirlmeier, 1979, Taf. 103).
Fig. 12. Map of the distribution of Geometric pendants (after I. Kilian-Dirlmeier, 1979, Taf. 107).
Fig. 13. Map of the distribution of Corinthian helmets (after H. Pflug, 1988b, Abb. 48).
Fig. 14. Map of the distribution of Illyrian helmets (after H. Pflug, 1988a, 47, 50, Abb. 6, 9).
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Fig.18. Imported votives of Greek origin in the sanctuaries at Olympia and Samos (after I. Kilian-Dirlmeier, 1985, 232, Abb. 14; 238, Abb. 19).
Fig. 19. Distribution of imported votives in the sanctuaries at Pherae and Perachora (after I. Kilian-Dirlmeier, 1985, 217, Abb. 1; 225, Abb. 8).
Fig. 20. Distribution of imported votives in the sanctuaries at Olympia and Samos (after I. Kilian-Dirlmeier, 1985, 231, Abb. 13; 237, Abb. 18).
Fig. 21. Imported votives of non-Greek origin in the sanctuaries at Pherae and Perachora (after I. Kilian-Dirlmeier, 1985, 223. Abb. 5; 227, Abb. 10).
Fig. 22. Imported votives of non-Greek origin in the sanctuaries at Olympia and Samos (after I. Kilian-Dirlmeier, 1985, 233, Abb. 15; 239, Abb. 20).

Fig. 23. 1—Lorenz curves of the distribution of vases and metal objects in Athenian adult burials of the Sub-Mycenean-Late Geometric periods; 2—Lorenz curves of the distribution of vases and metal objects in Athenian adult burials in the 1st and 2nd Late Geometric periods; 3—proportion of intact adult burials with metal objects and without them in Athens (after I.Morris, 1987, 142, 143, 150, figs. 48-49, 53).
Fig. 24. Distribution map of Etruscan "Schnabelkannen" (after W. Kimmig, 1983, 41, Abb. 32).
Fig. 25. Histogrammes of metal analyses of Geometric bronzes (after E.A. Sanpaolo, 1990, 119-121, fig. 44, 47-48, 50).
Fig. 26. 1—plan of the workshop of Phidias at Olympia (after J. de Waele, 1988, 391, Abb. 2); 2—plan of the sanctuary of Zeus at Nemea (after S. Miller, 1983, 71, fig. 1).
Fig. 27. Cassope. Plan of the city with the Agora and public buildings (the Early Hellenistic period) (after W. Hoepfner, E.-L. Schwandner, 1994, Abb. 64).
Fig. 28. Olynthus. Plans of buildings with rooms for workshops (after W. Hoepfner, E.-L. Schwandner, 1994).
Fig. 29. Olynthus and Abdera. Plans of habitation blocks with rooms for shops and workshops (after W. Hoepfner, E.-L. Schwandner, 1994).
Fig. 30. Major centres for the manufacture of mirrors with caryatid handles (after L.O. K. Congdon, 1981, 45).
Fig. 31. Distribution map of Apulo-Corinthian helmets (after A. Bottini, 1988, 110, Abb. 3).
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Fig. 34. Dynamics of coin issues of Cnidus and Syde (after T. Hackens, 1987, figs. 2-3).
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Fig. 36. Distribution of Attic black-glazed ware in Cameiros and Maryon in the 5th century B.C. (after D.W.J. Gill, 1988, 179, fig. 2).
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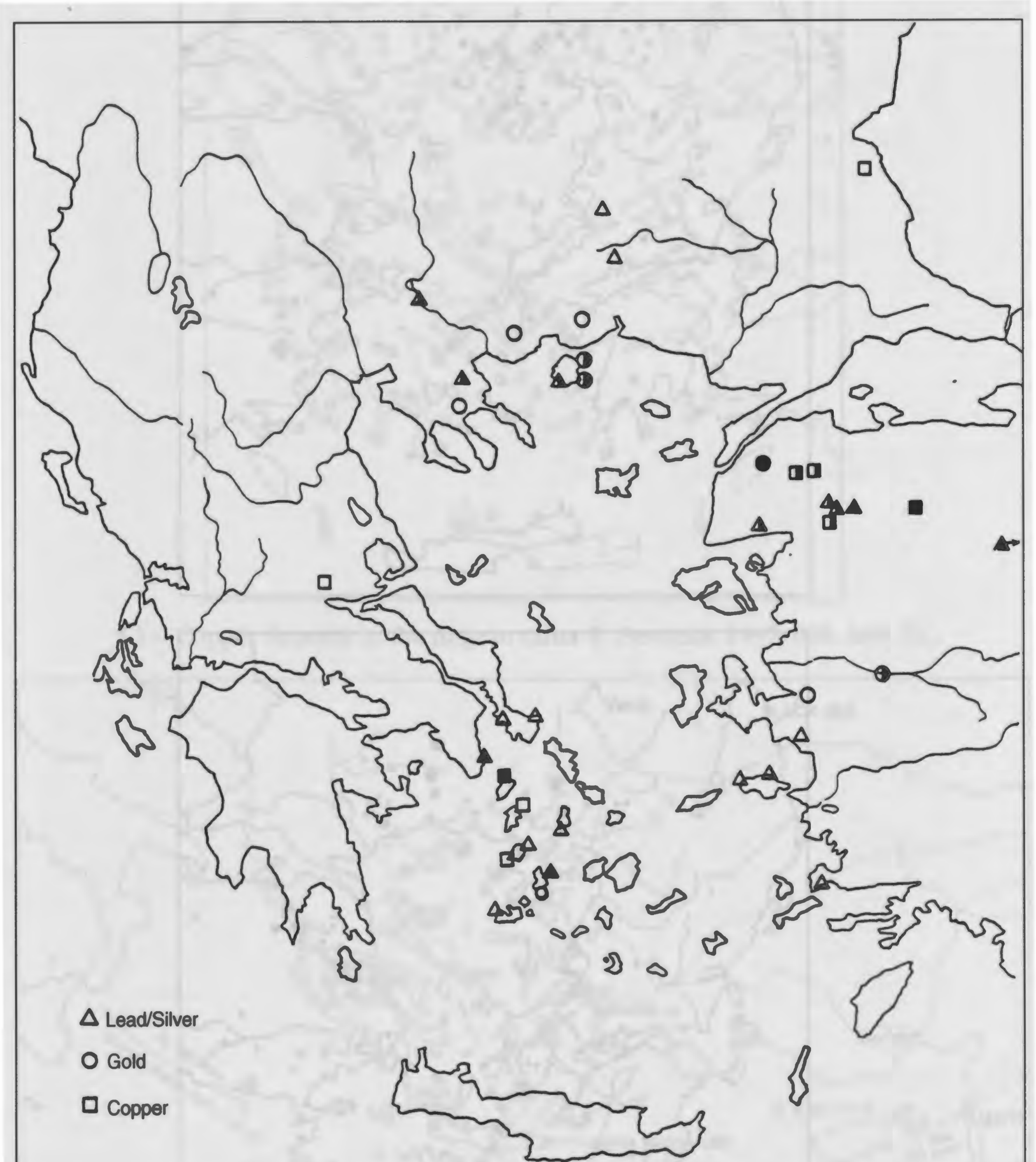
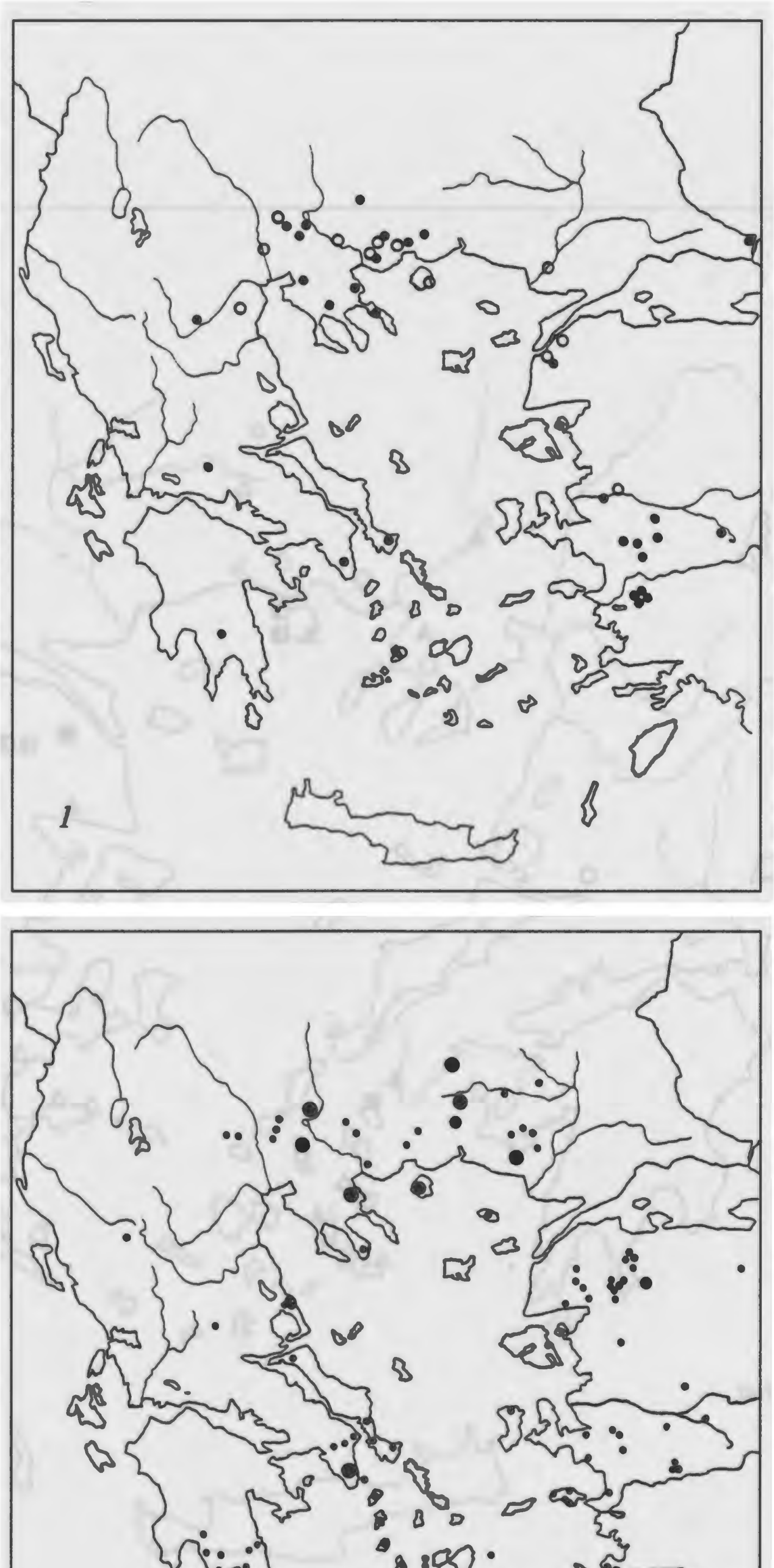
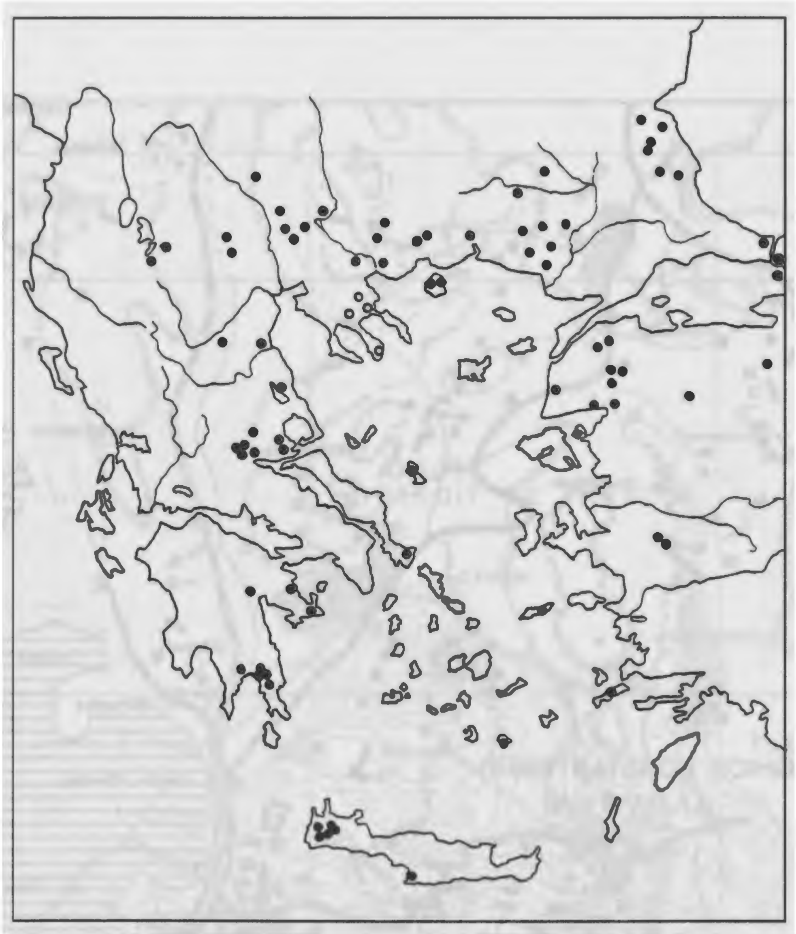
ILLUSTRATIONS



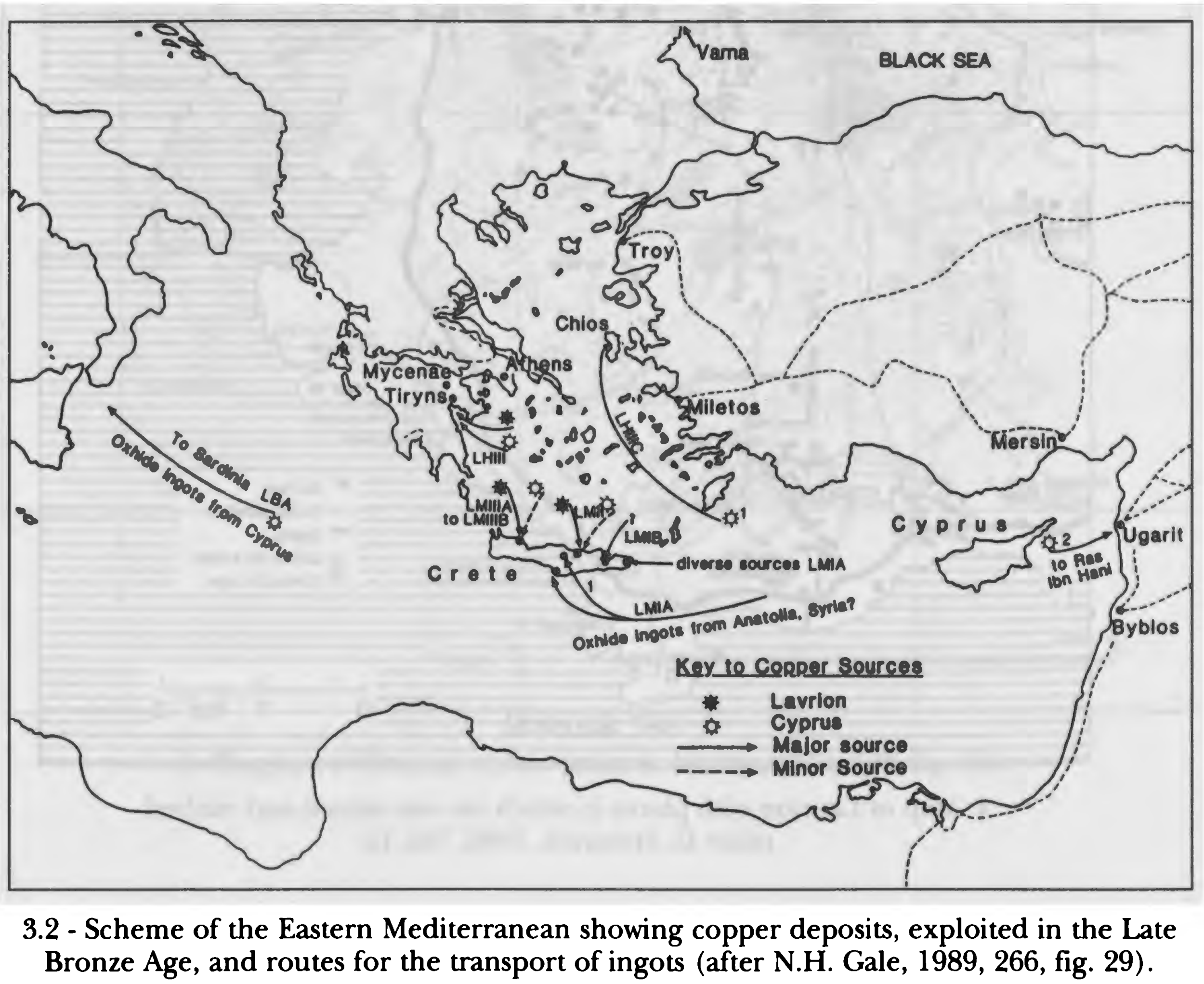

1. Lead, Silver, Gold and Copper deposits in the Aegean in the Bronze Age and Antiquity (after E. Pernicka, 1987, 679, Abb. 28).



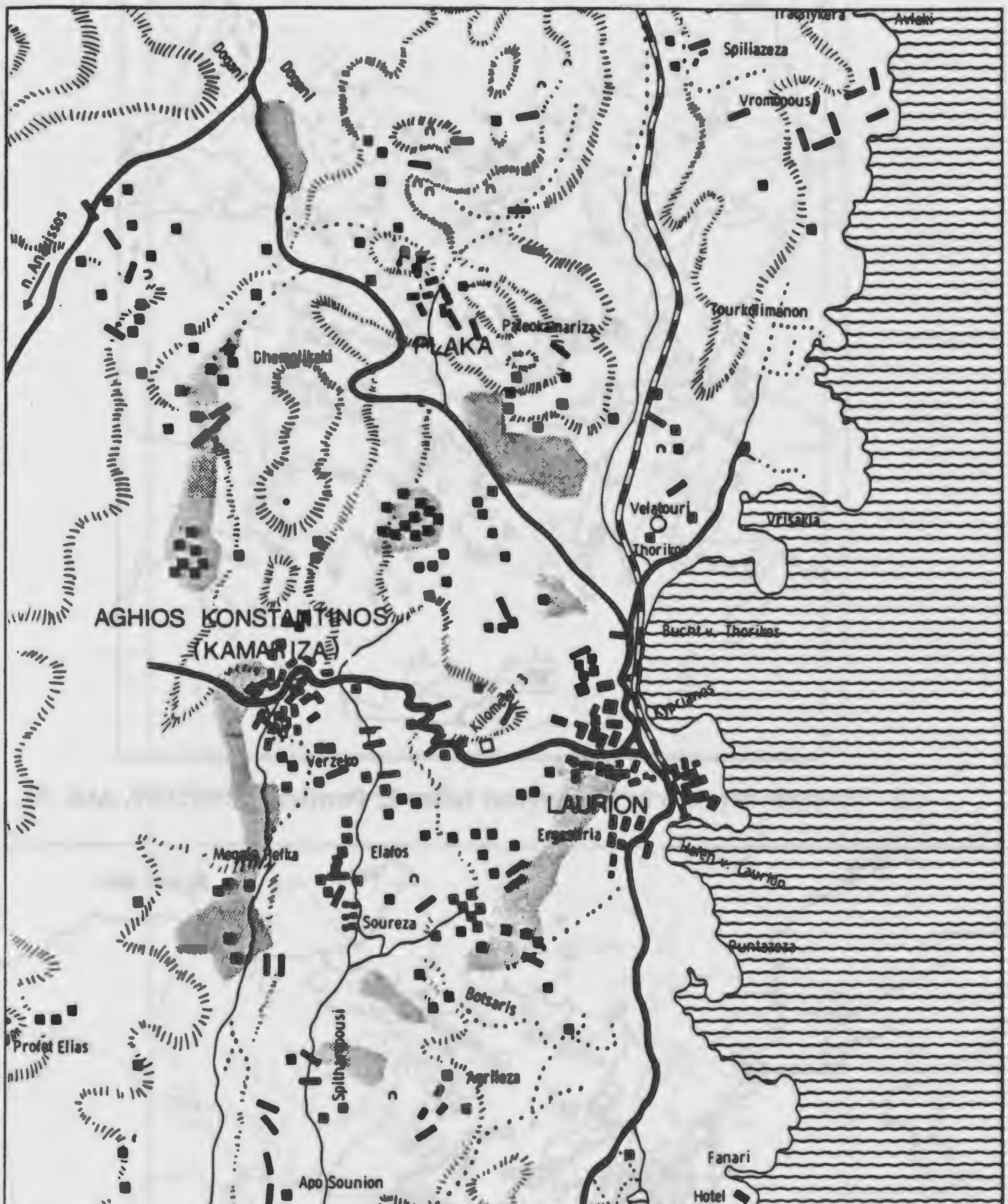

2. Gold and Lead Deposits in the Aegean: 1 - gold deposits; 2 - lead deposits (after E. Pernicka, 1987, 622, Abb. 7; 621, Abb. 6).



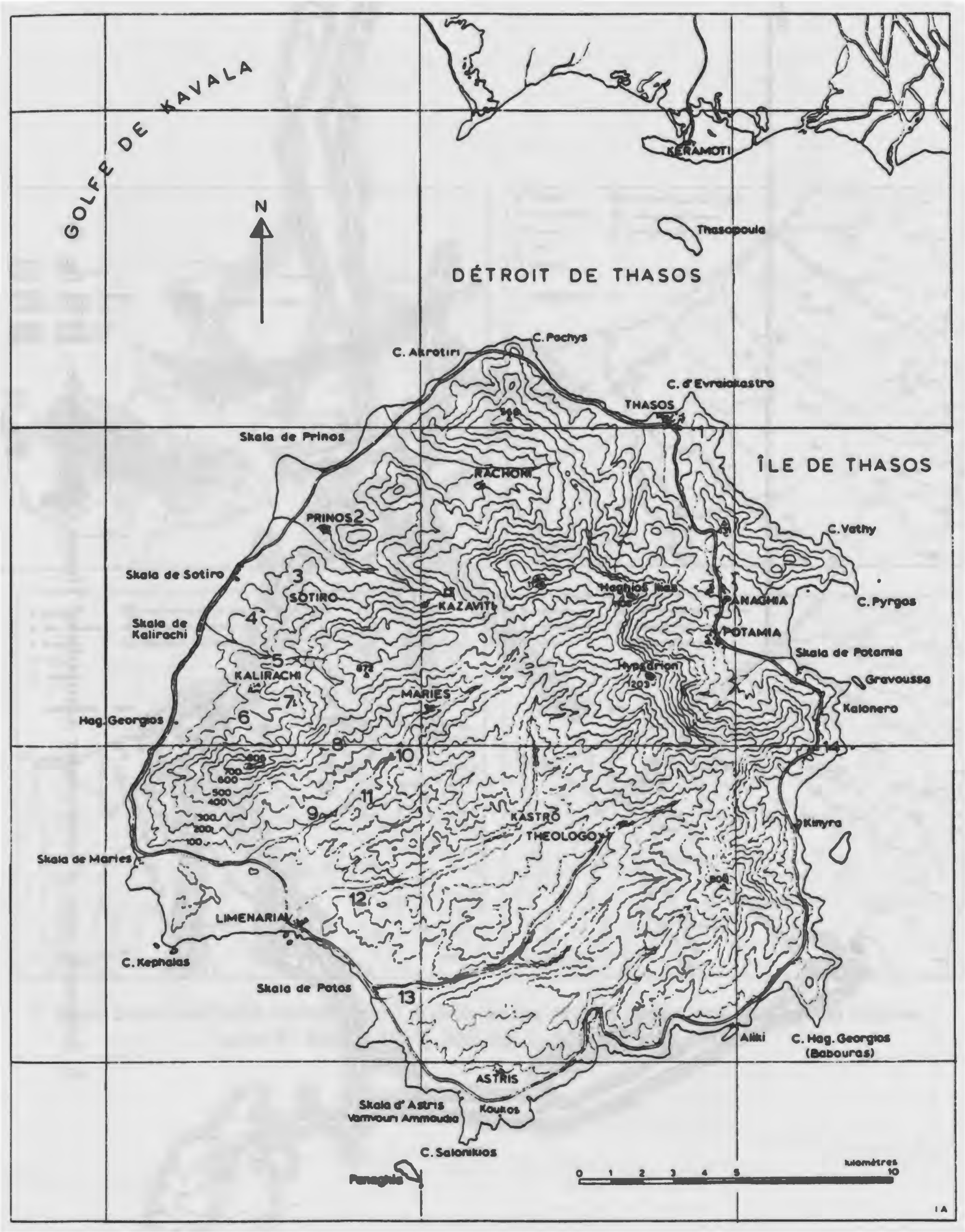
3.1 - Copper deposits in the Aegean (after E. Pernicka, 1987, 620, Abb. 5).



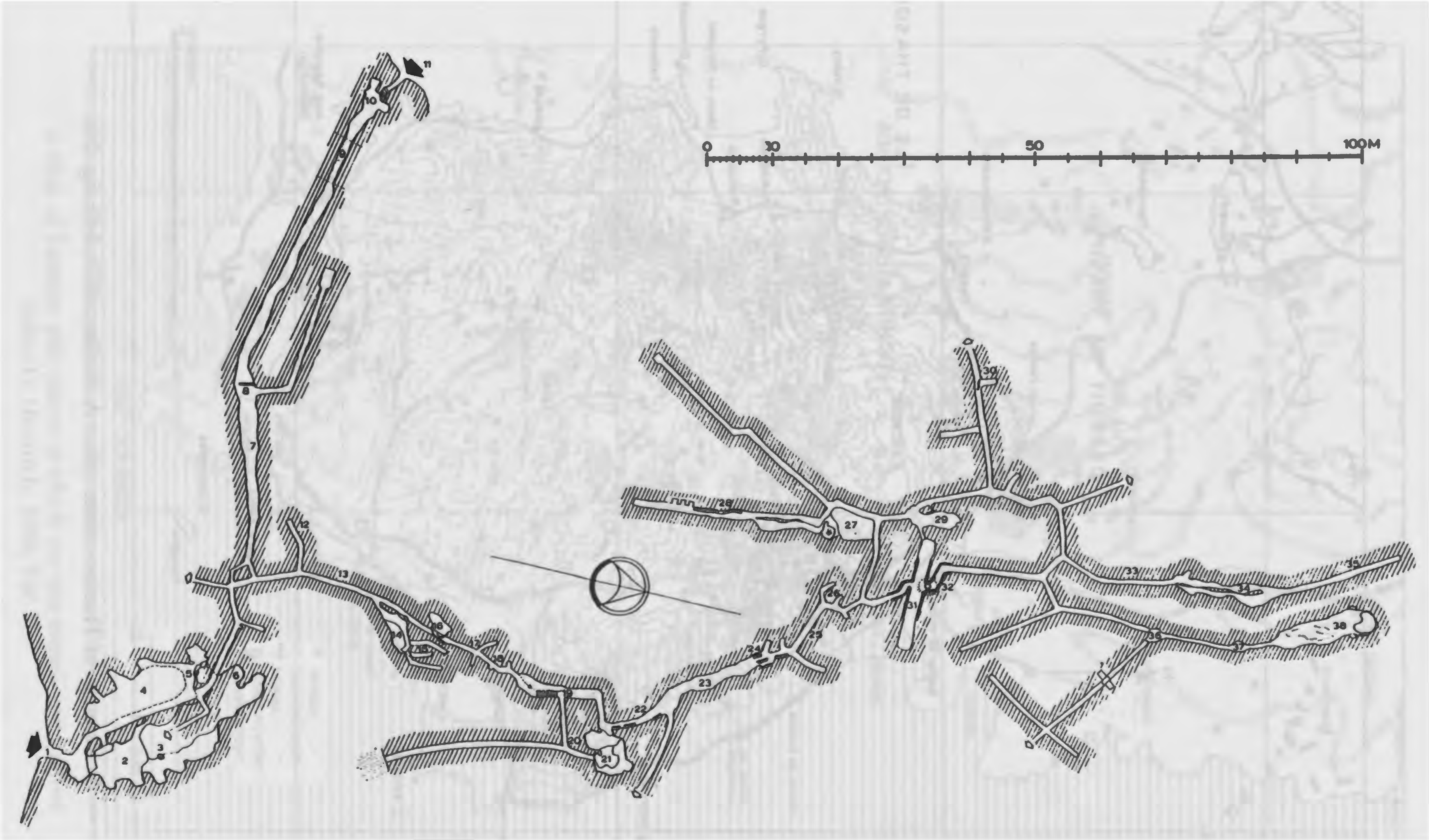

3.2 - Scheme of the Eastern Mediterranean showing copper deposits, exploited in the Late Bronze Age, and routes for the transport of ingots (after N.H. Gale, 1989, 266, fig. 29).



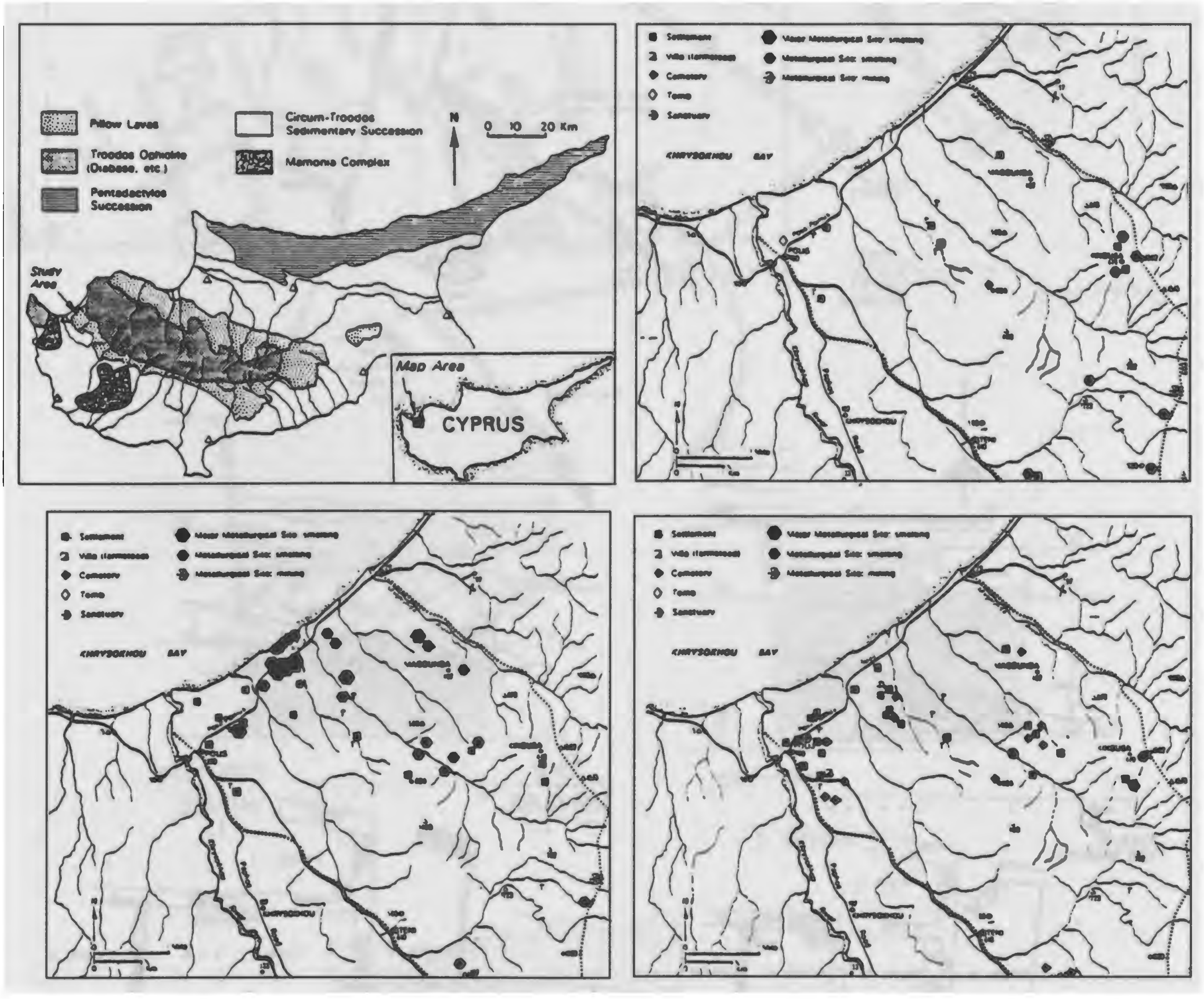

4. Map of Laurion with places in which ore was mined and washed (after G. Heinrich, 1986, Taf. I).



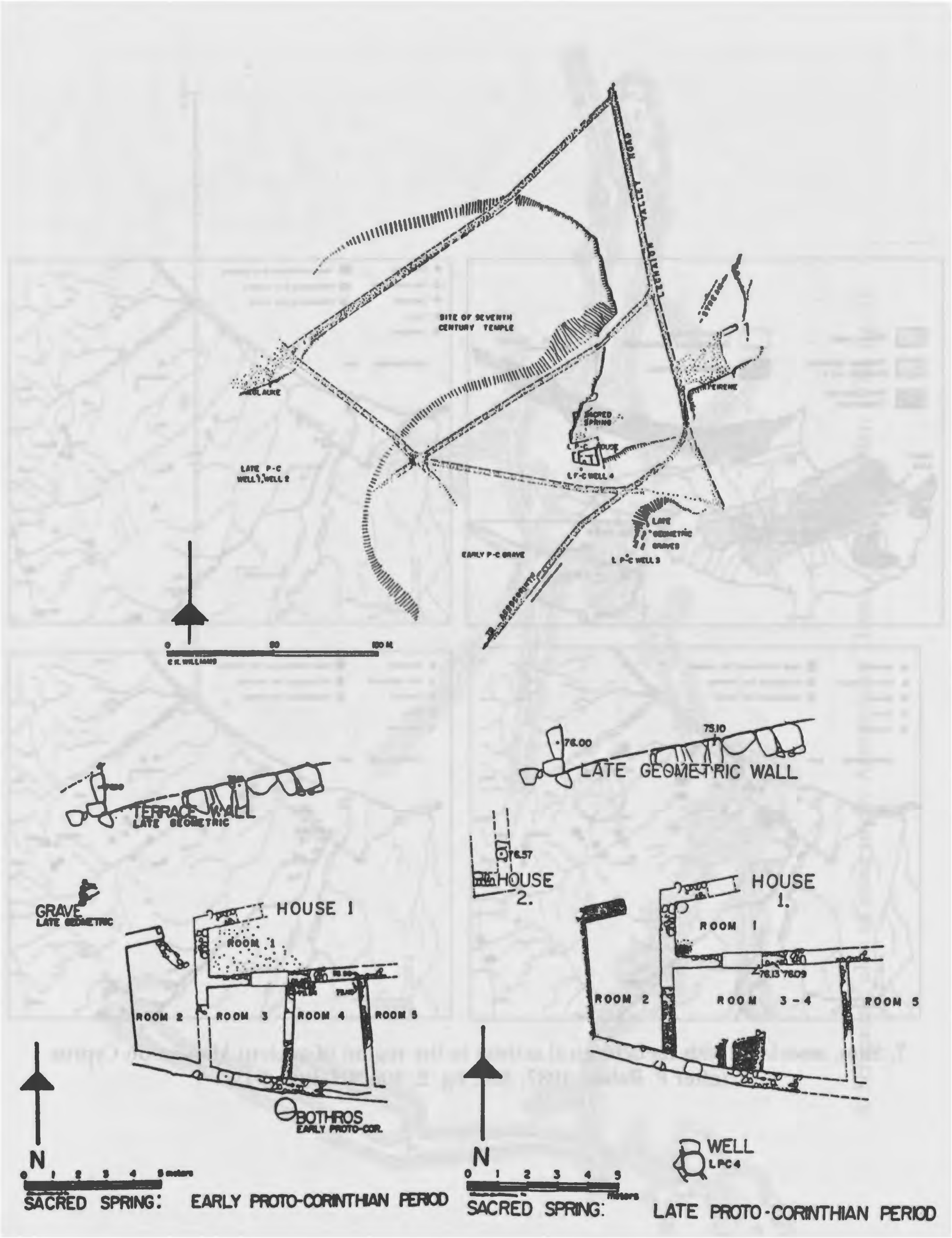

5. Diagram of Thasian mines (after A. Muller, 1979, 343, fig. 24).



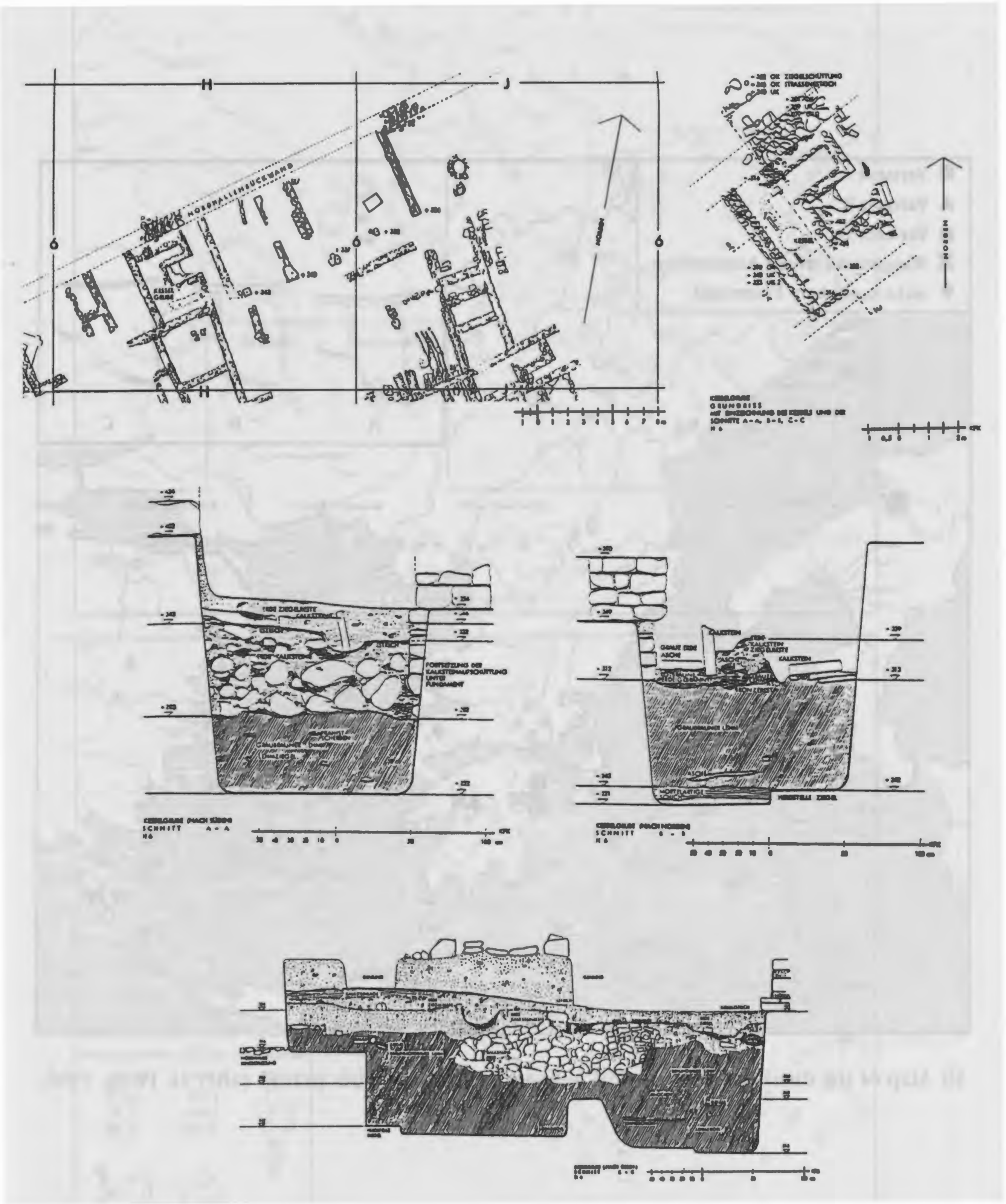

6. Schematic plan of mine under Acropolis of Thasos (after A. Muller, 1979, fig. 3).



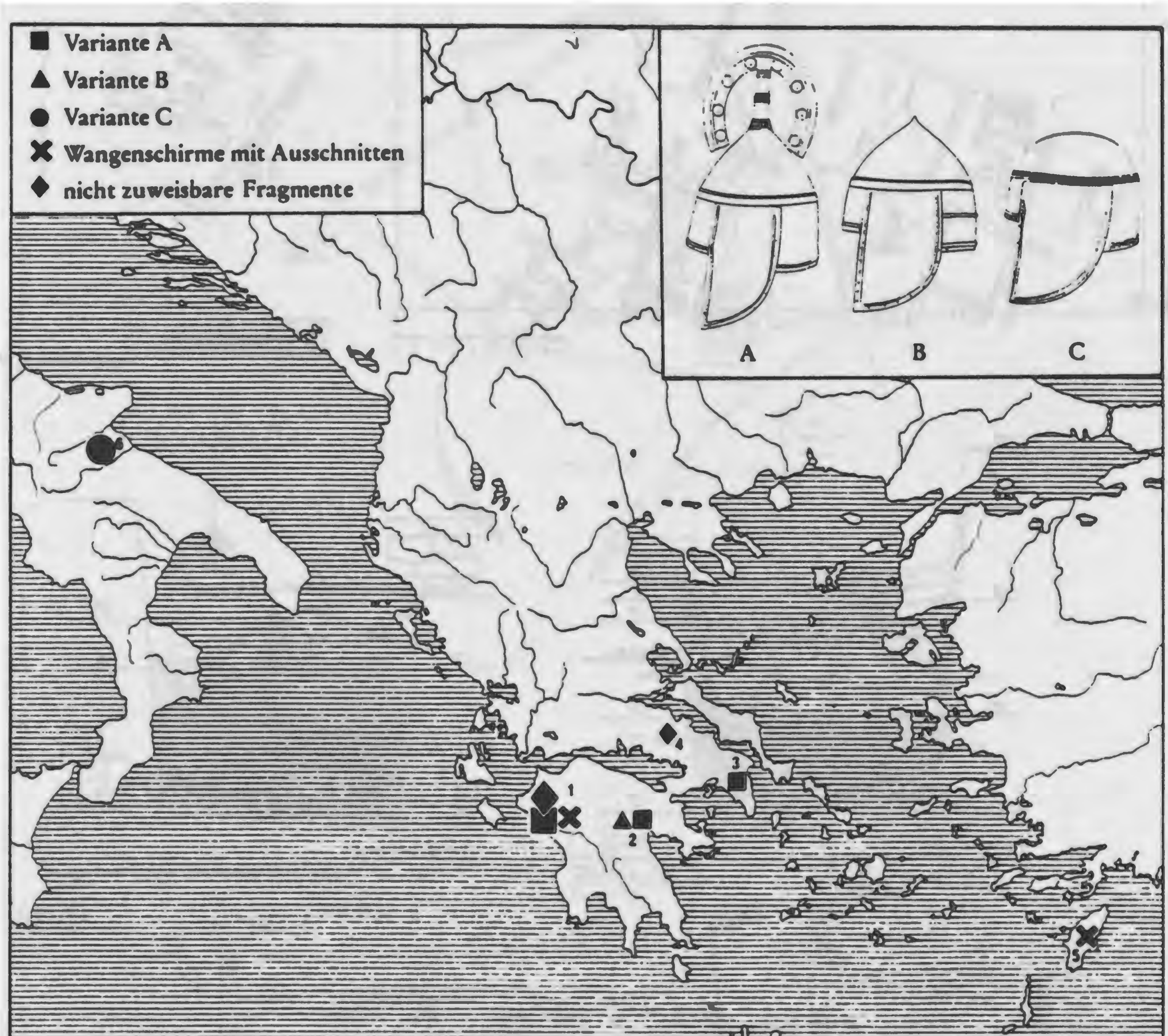

7. Sites, associated with metallurgical activity in the region of ancient Maryon on Cyprus (after P. Raber, 1987, 300, fig. 2; 306-307, figs. 3-4).



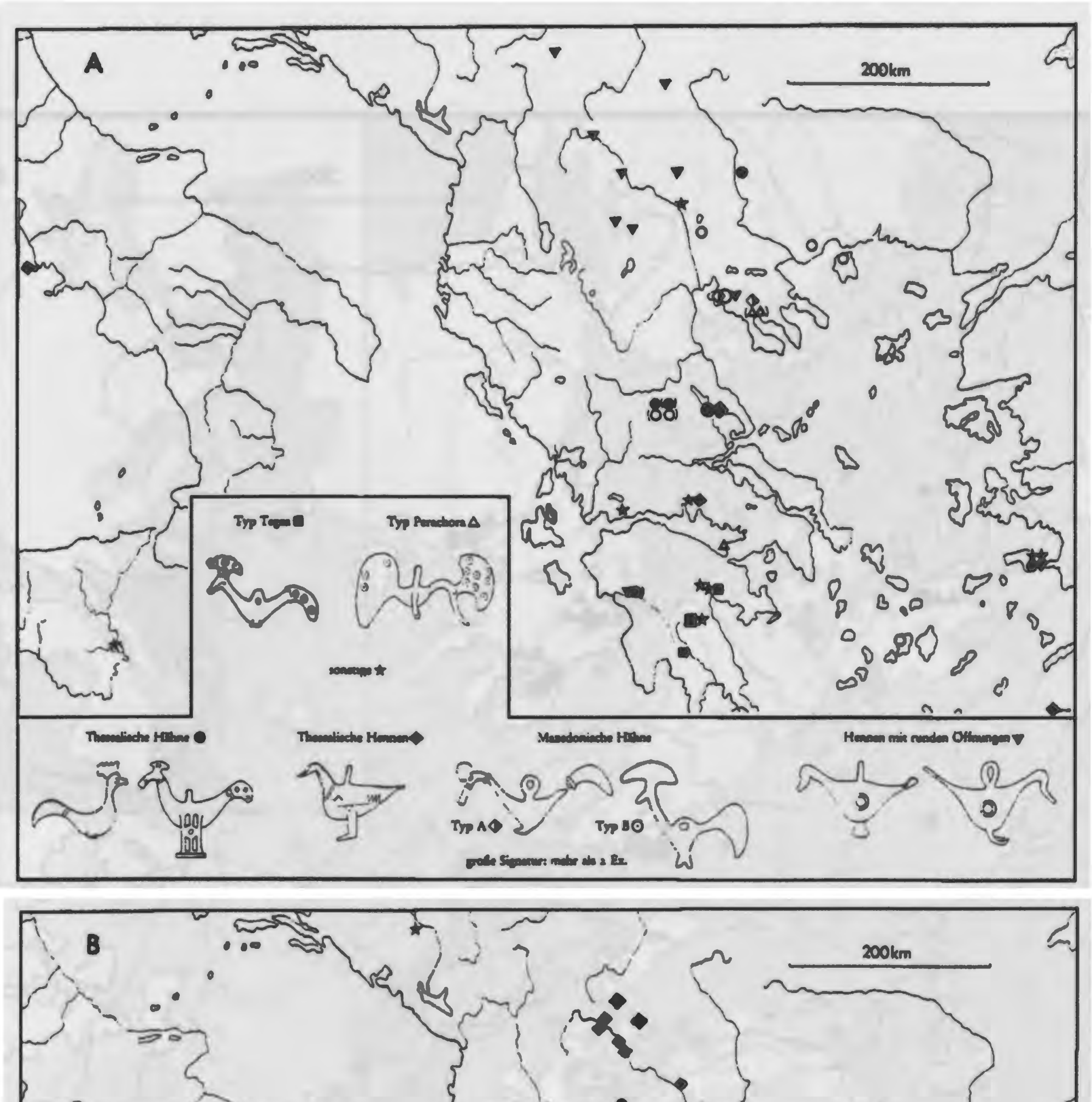

8. Plan of the metalworkshop of the 7th century B.C. in Corinth (after Ch.K. II. Williams, J.E. Fisher, 1971, figs. 1-3).



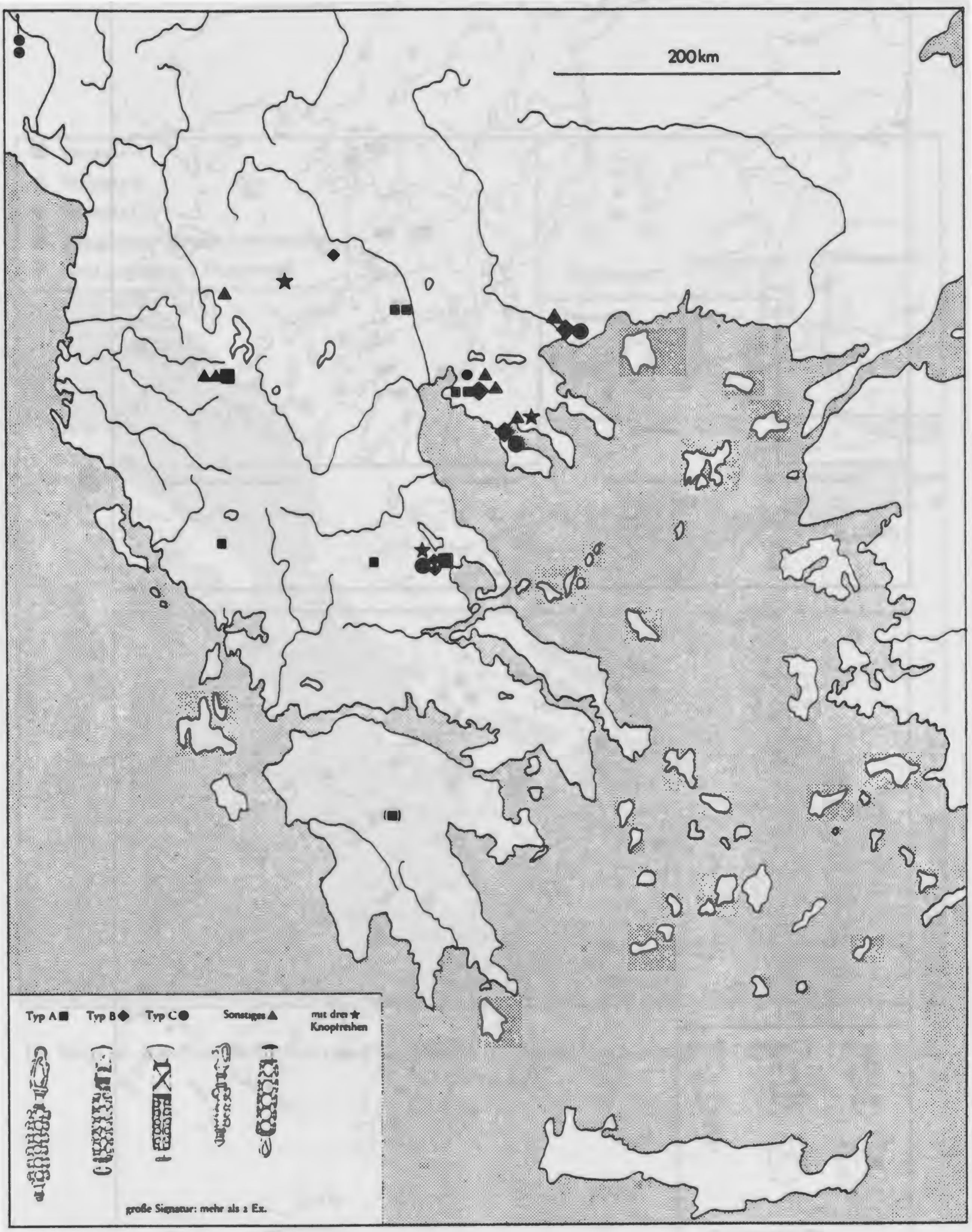
9. Plan of the 6th century B.C. casting pit at Heraion on Samos with the location of the Brychon votive find (after G. Schmidt, 1972, Abb. 1-5).



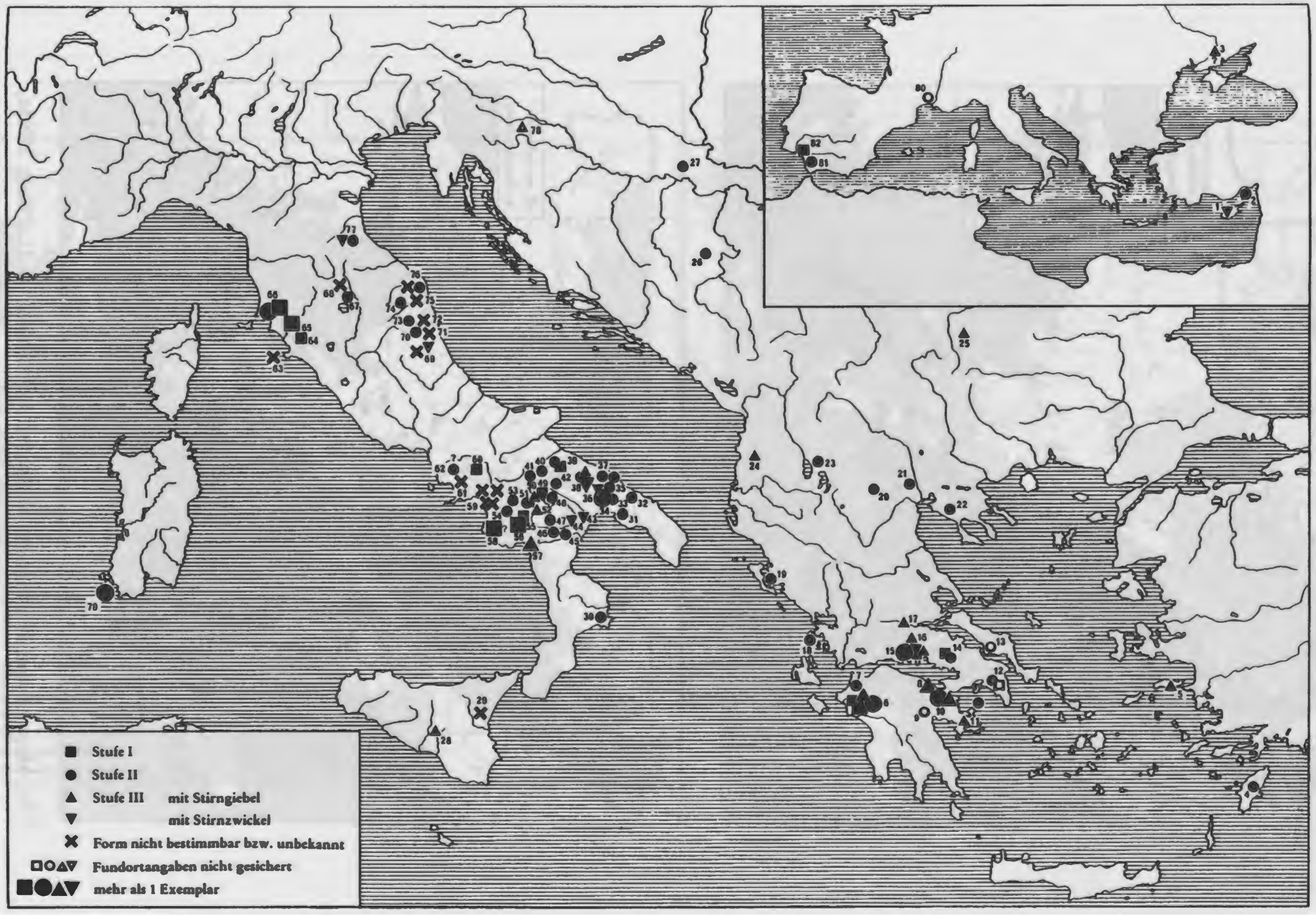

10. Map of the distribution of conical helmets of the Geometric period (after H. Pflug, 1988, 21, Abb. 10).



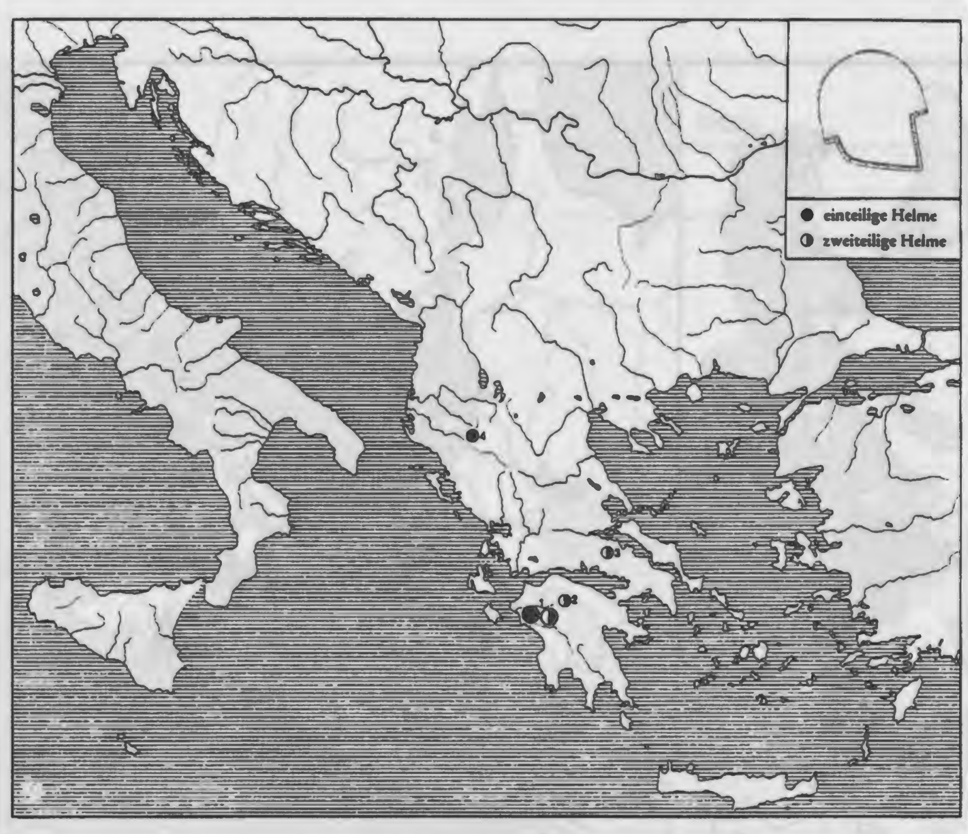

11. Maps of the distribution of Geometric pendants
(after I. Kilian-Dirlmeier, 1979, Taf. 103).

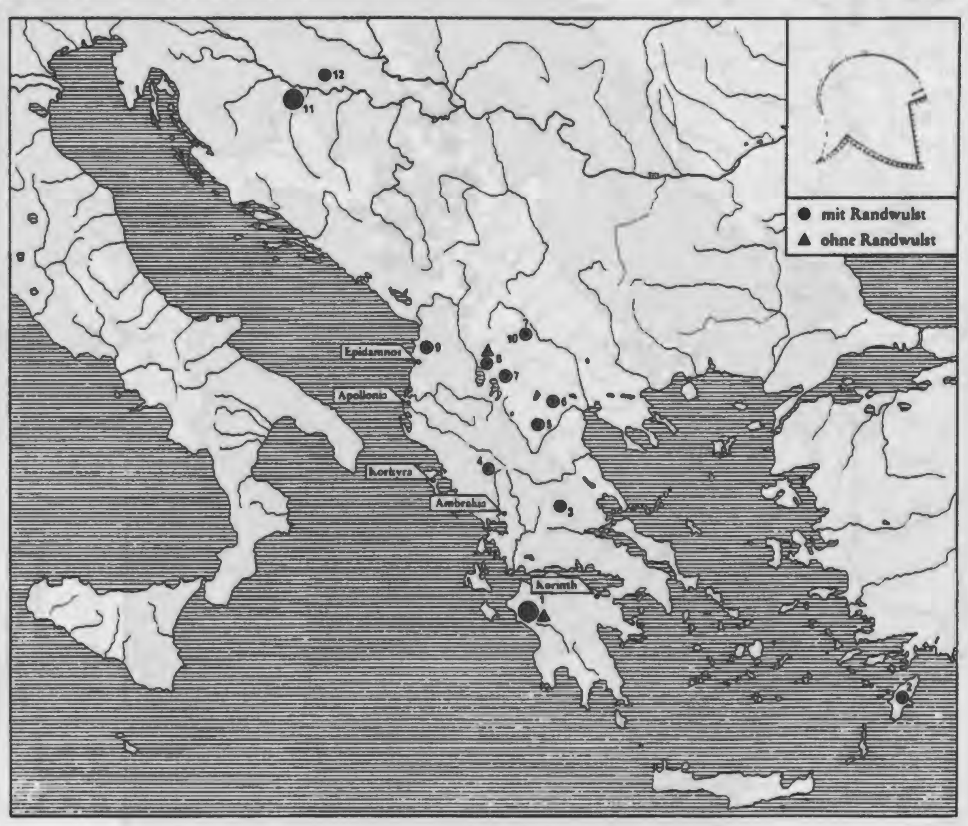



12. Map of the distribution of Geometric pendants (after I. Kilian-Dirlmeier, 1979, Taf. 107).

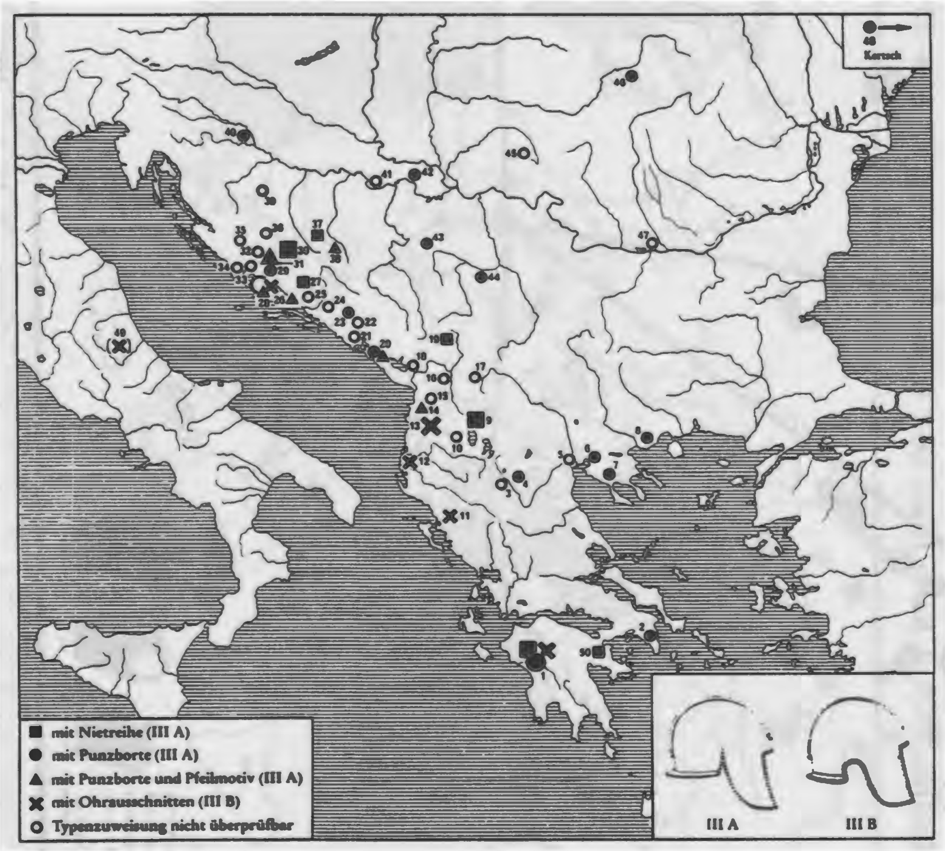


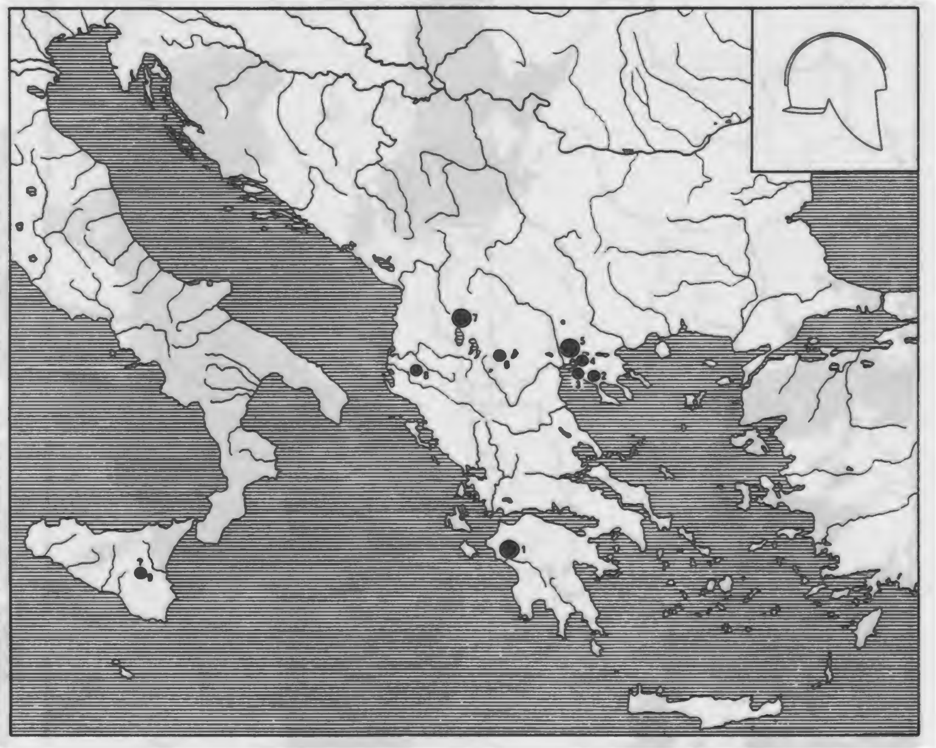

13. Map of the distribution of Corinthian helmets (after H. Pflug, 1988b, Abb. 48).



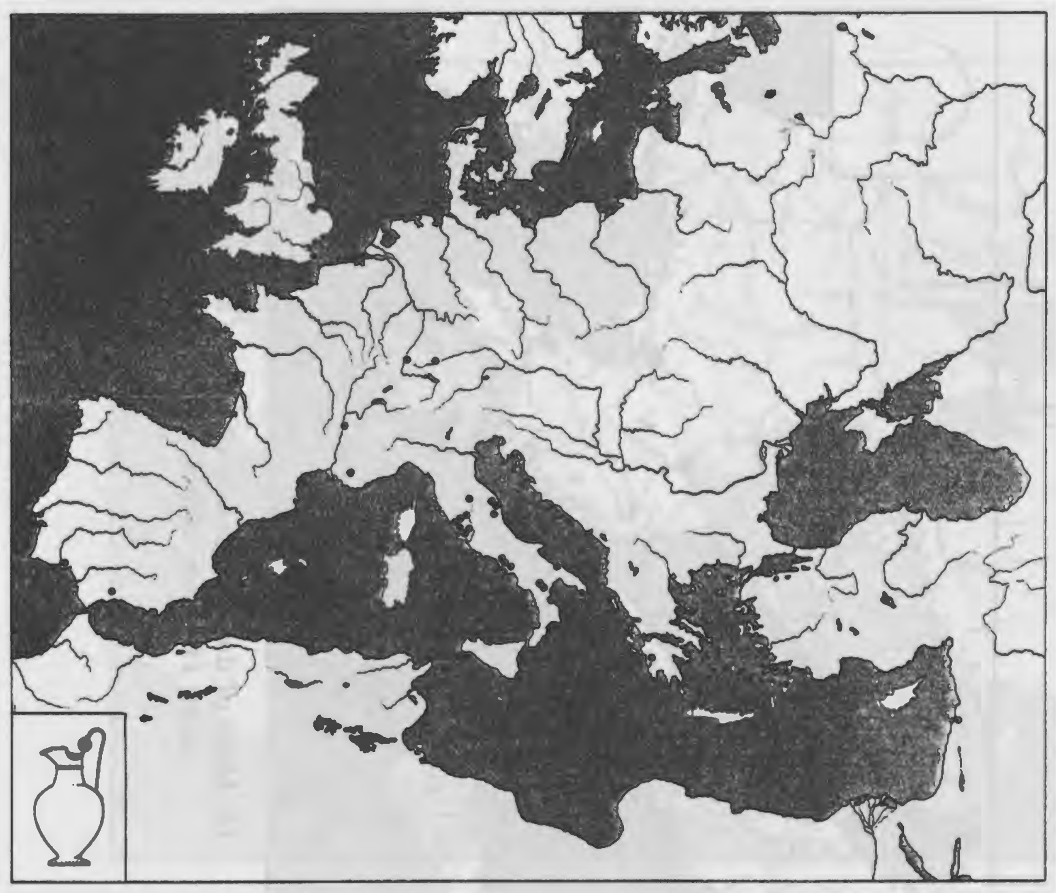




14. Maps of the distribution of Illyrian helmets (after H. Pflug, 1988a, 47, 50, Abb. 6, 9).



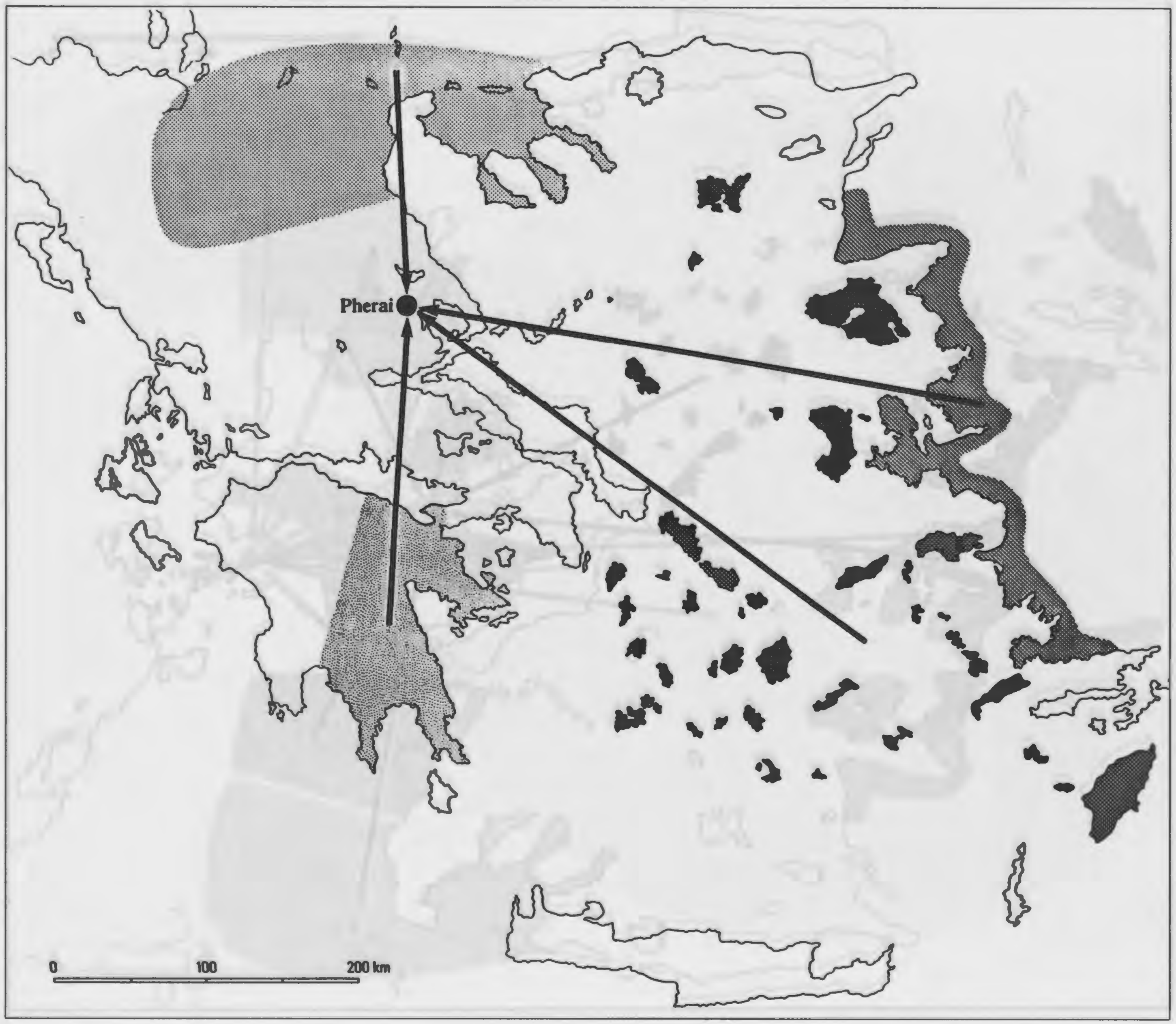



15. Maps of the distribution of Illyrian helmets, type III
(after H. Pflug, 1988a, 57, 62, Abb. 14, 19).

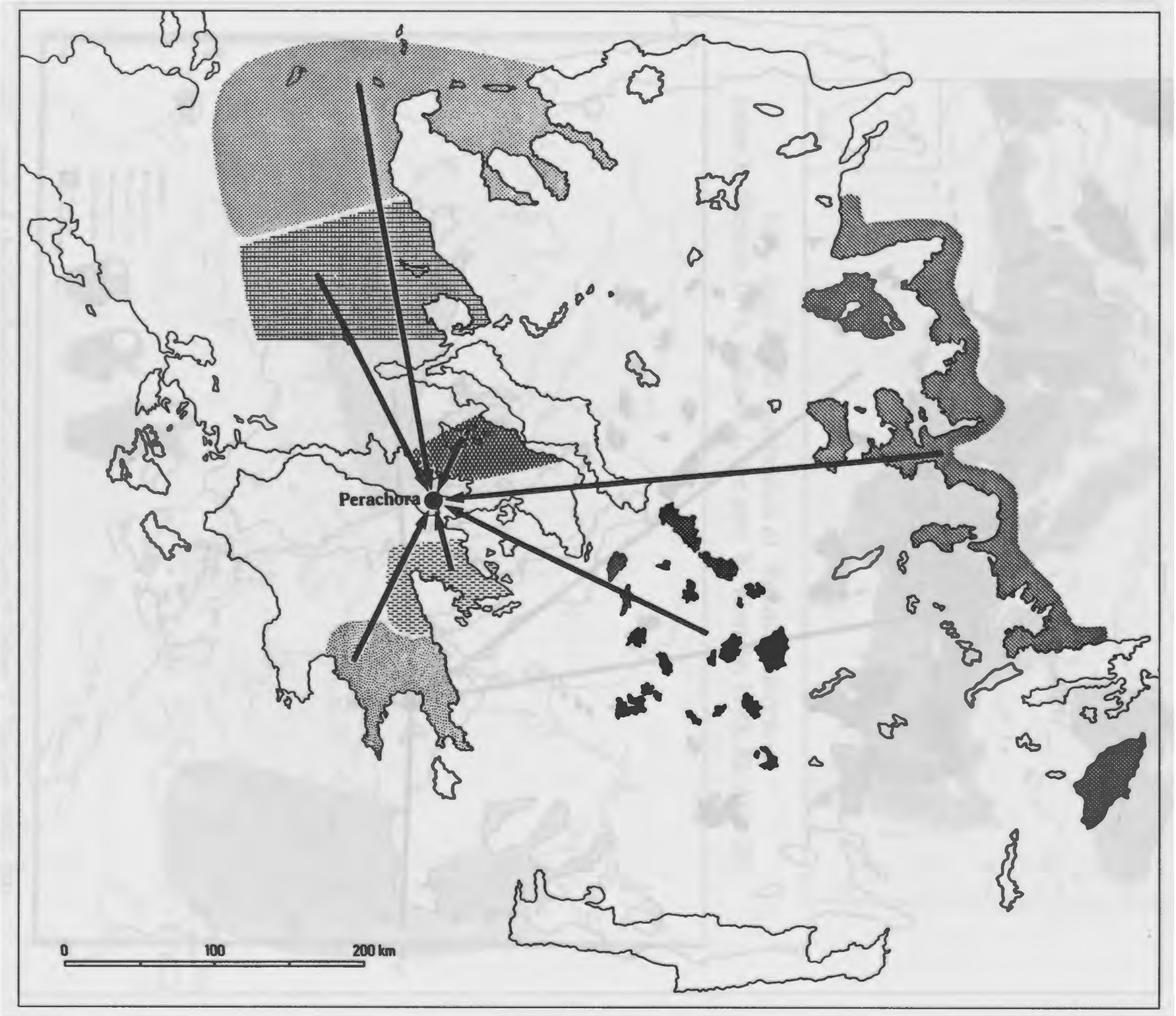


16.1 - map of the distribution of “Rhodian oinochoai
(after B. Shefton,1979, 9, Karte 1; see also: W. Kimmig, 1983, 32, Abb. 23).

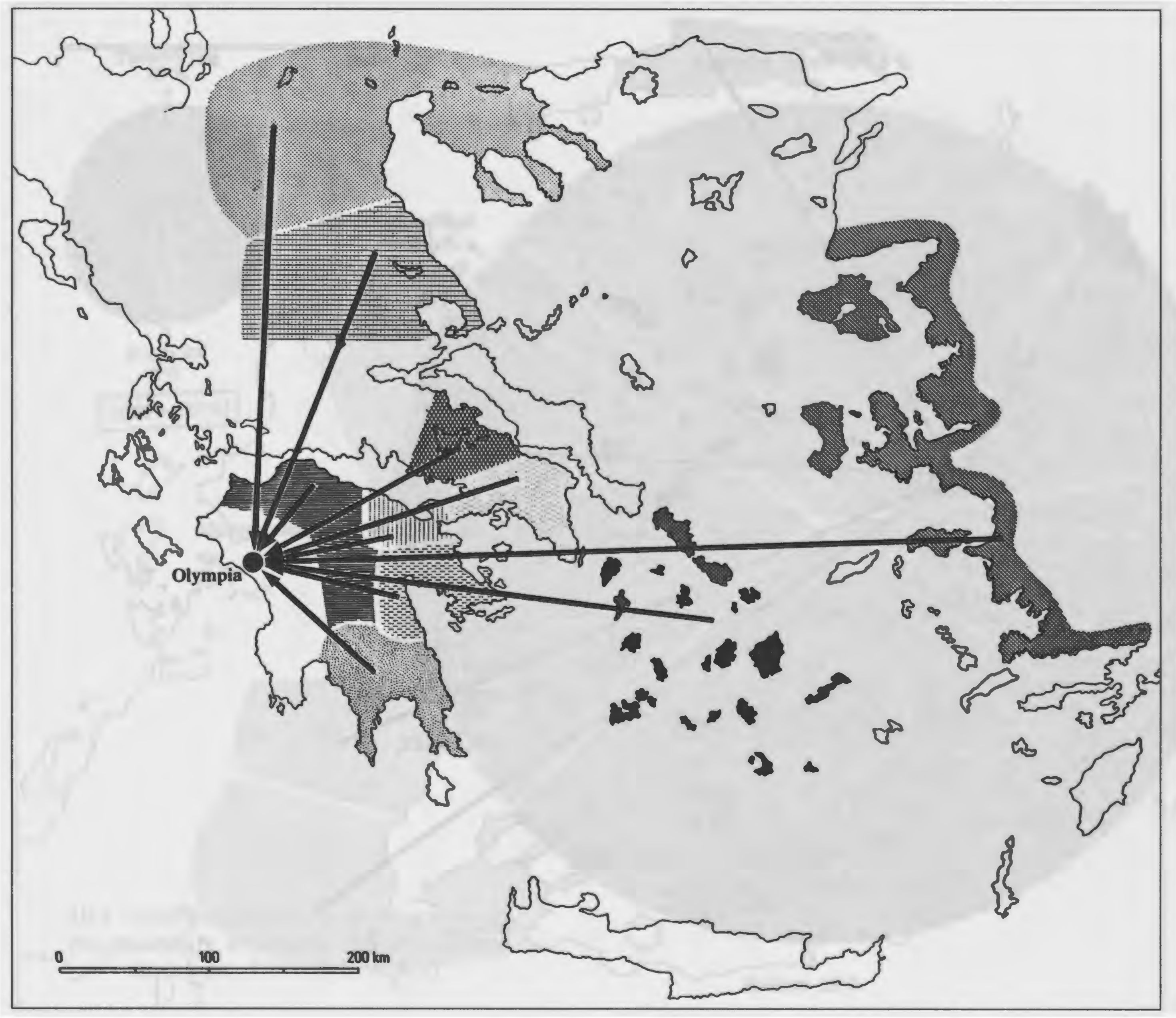
16.2 - map of the distribution of oinochoai, form 2 (after T. Weber, 1983, 99).



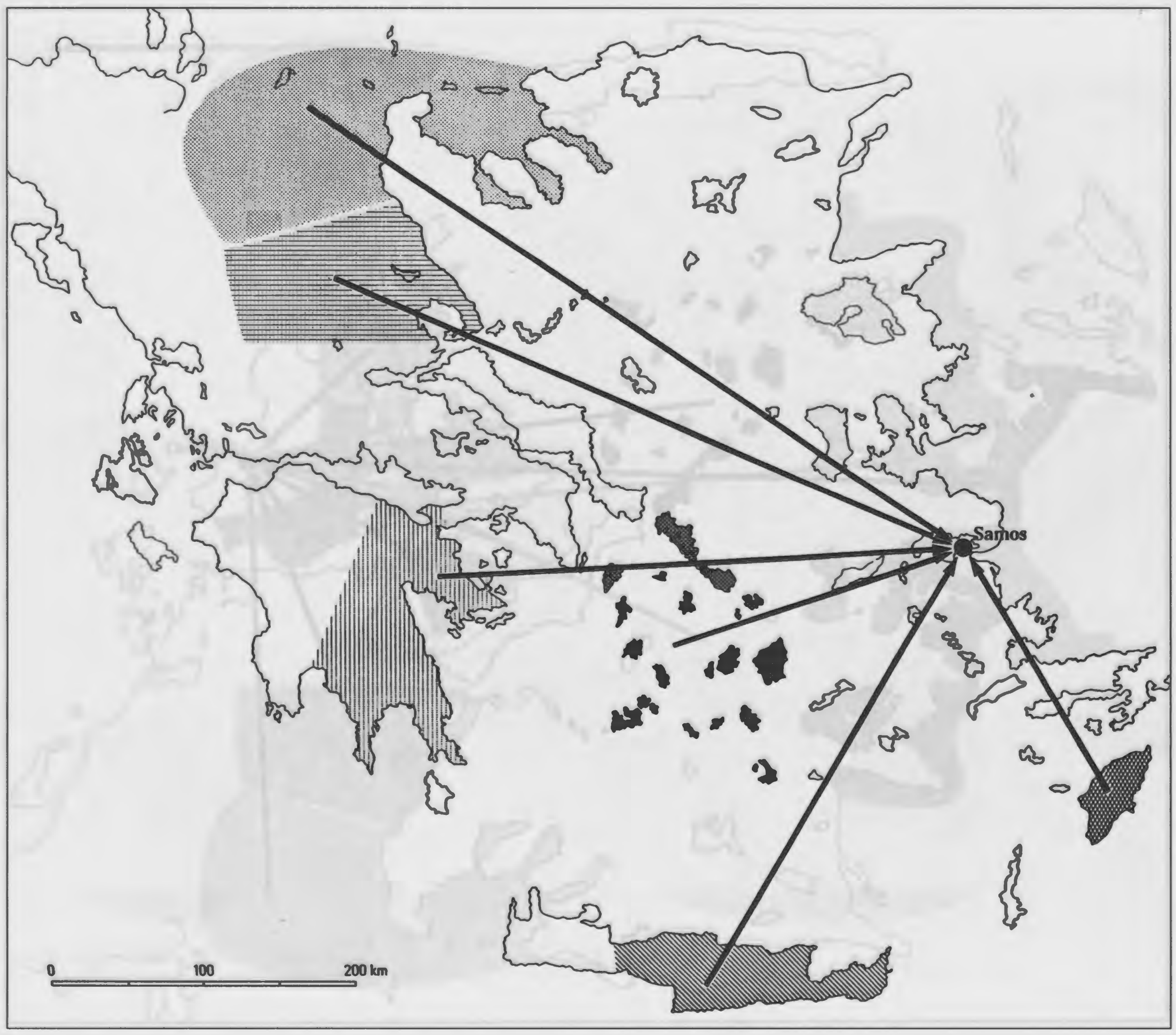

17.1- imported votives of Greek origin in the sanctuary at Pherae (after I. Kilian-Dirlmeier, 1985, 222, Abb. 4).



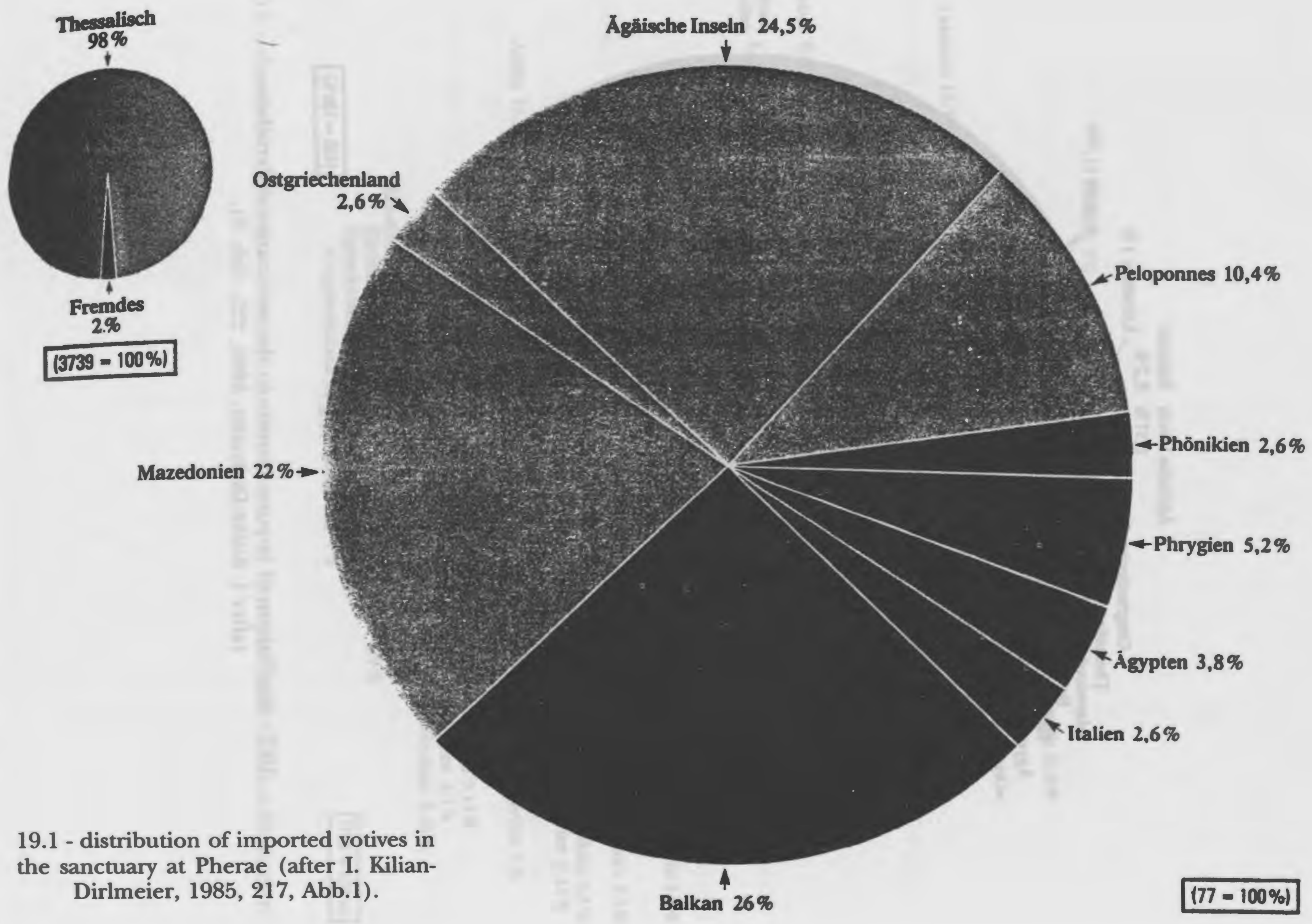

17.2- imported votives of Greek origin in the sanctuary at Perachora (after I. Kilian-Dirlmeier, 1985, 226, Abb. 9).



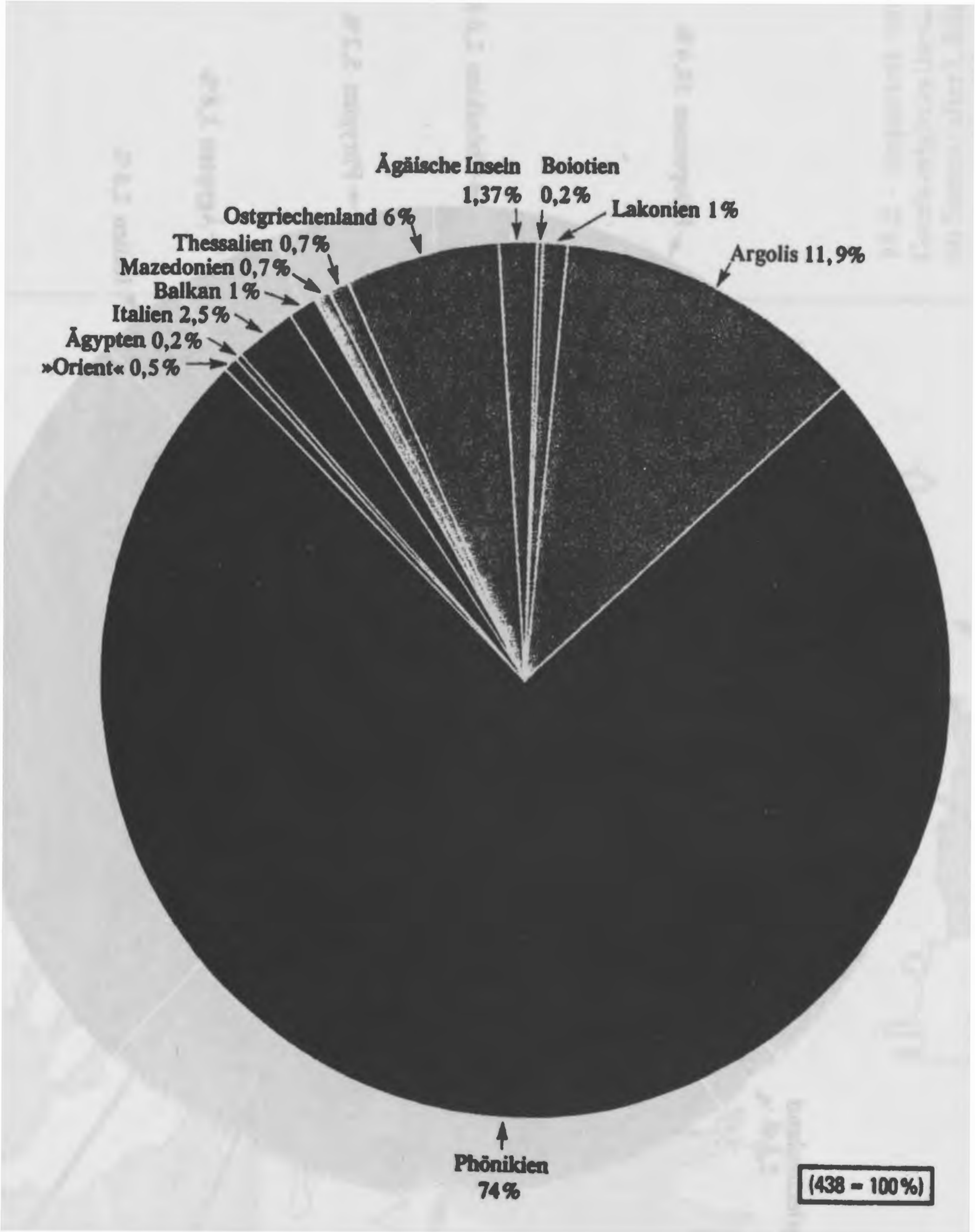

18.1 - imported votives of Greek origin in the sanctuary at Olympia (after I. Kilian-Dirlmeier, 1985, 232, Abb. 14).



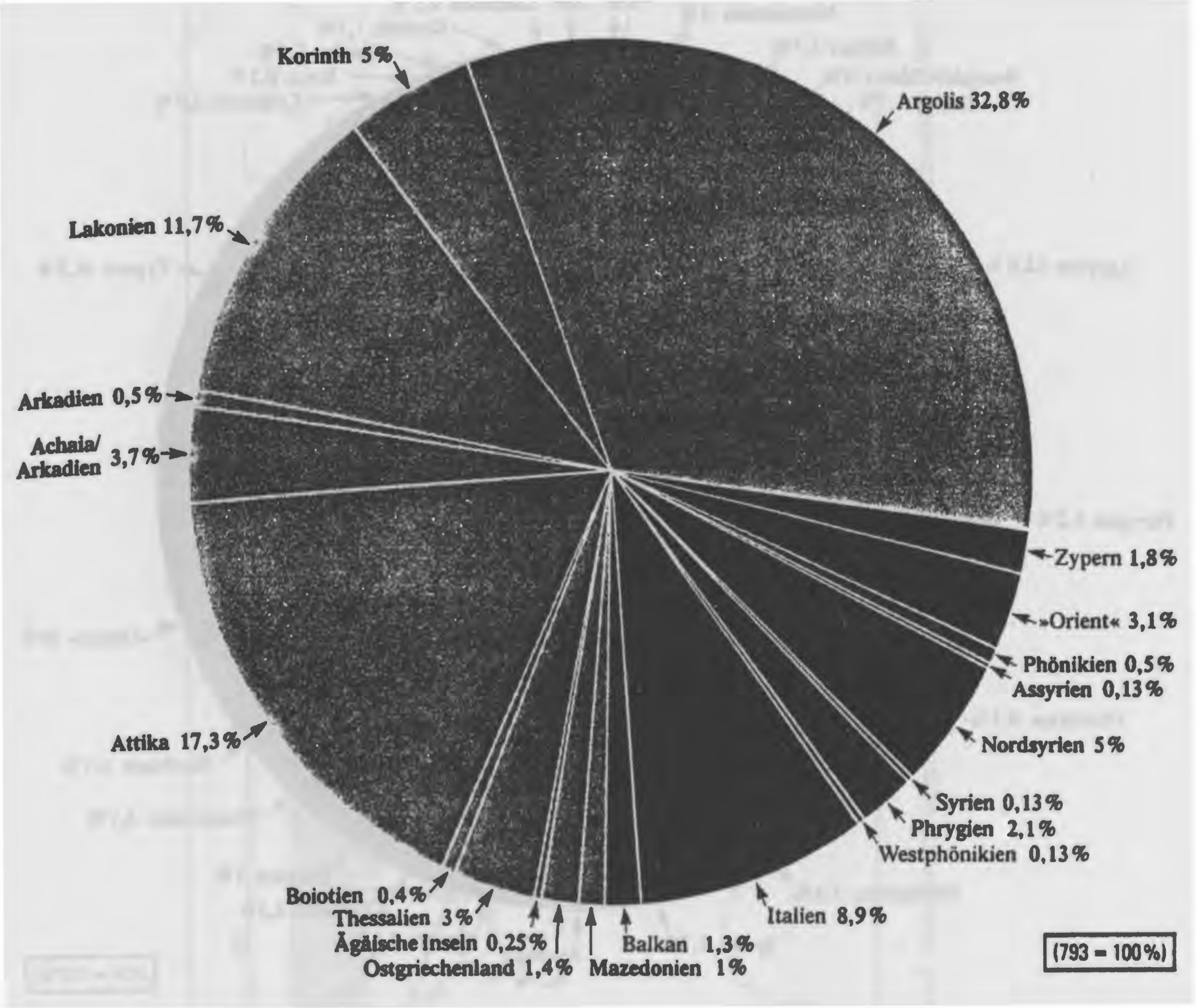

18.2 - imported votives of Greek origin in the sanctuary on Samos (after I. Kilian-Dirlmeier, 1985, 238, Abb. 19).



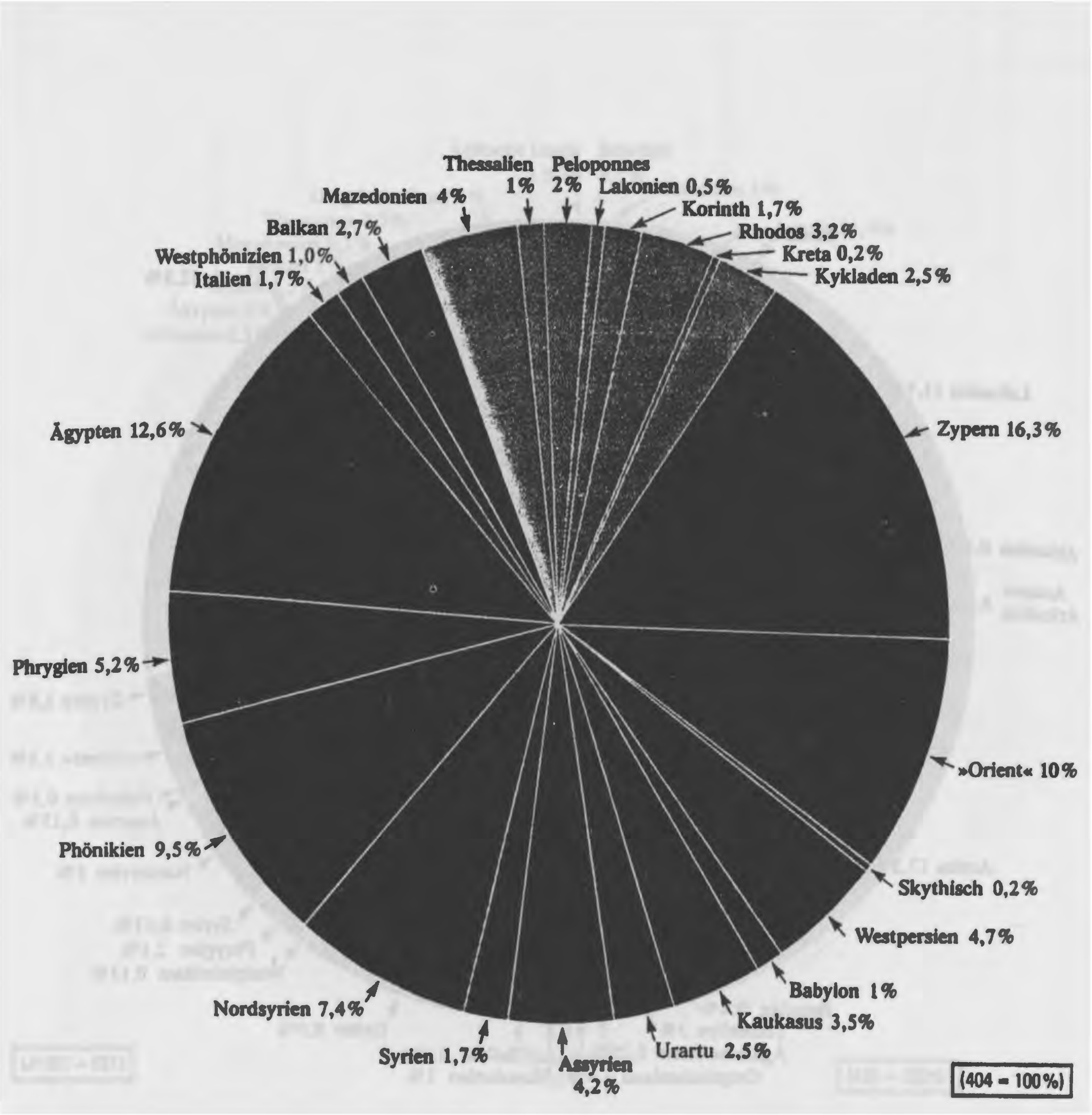

19.1 - distribution of imported votives in the sanctuary at Pherae (after I. Kilian-Dirlmeier, 1985, 217, Abb.1).



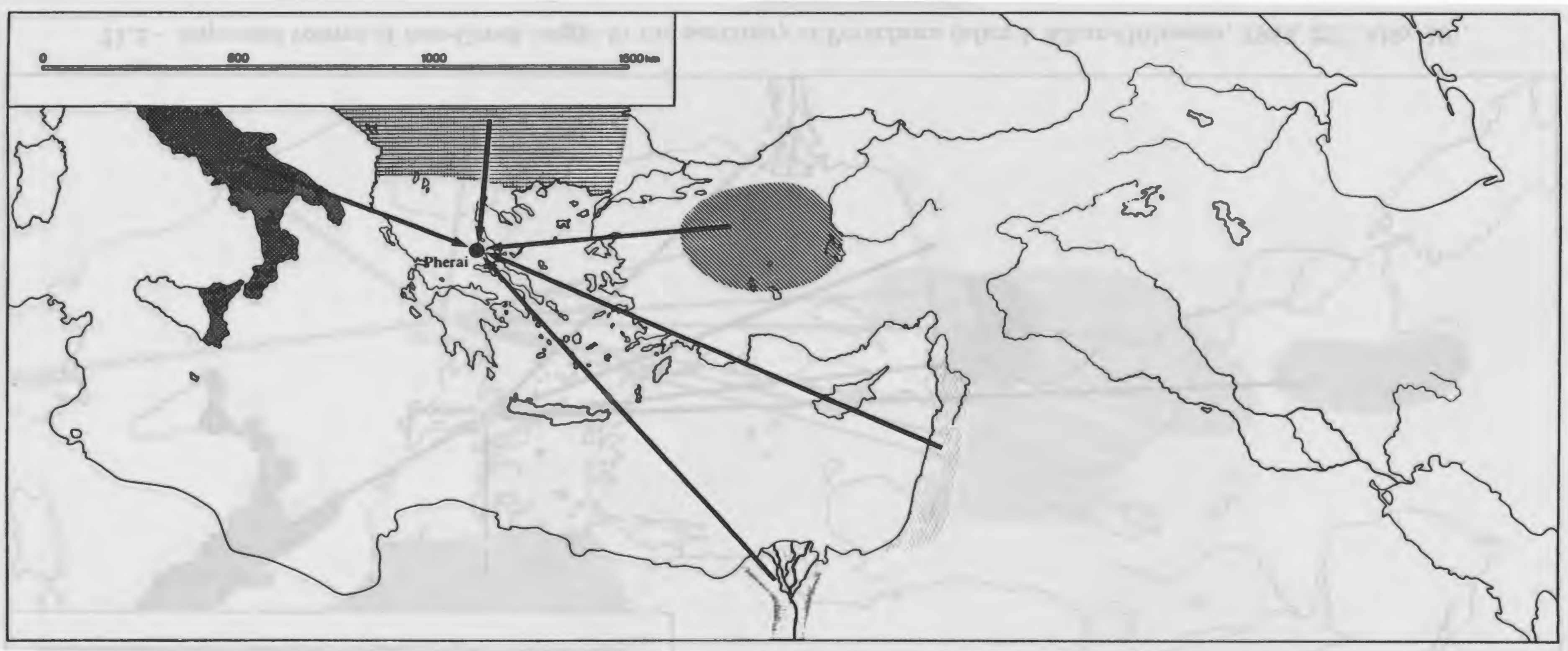

19.2 - distribution of imported votives in the sanctuaries at Perachora (after I. Kilian-Dirlmeier, 1985, 225, Abb. 8).



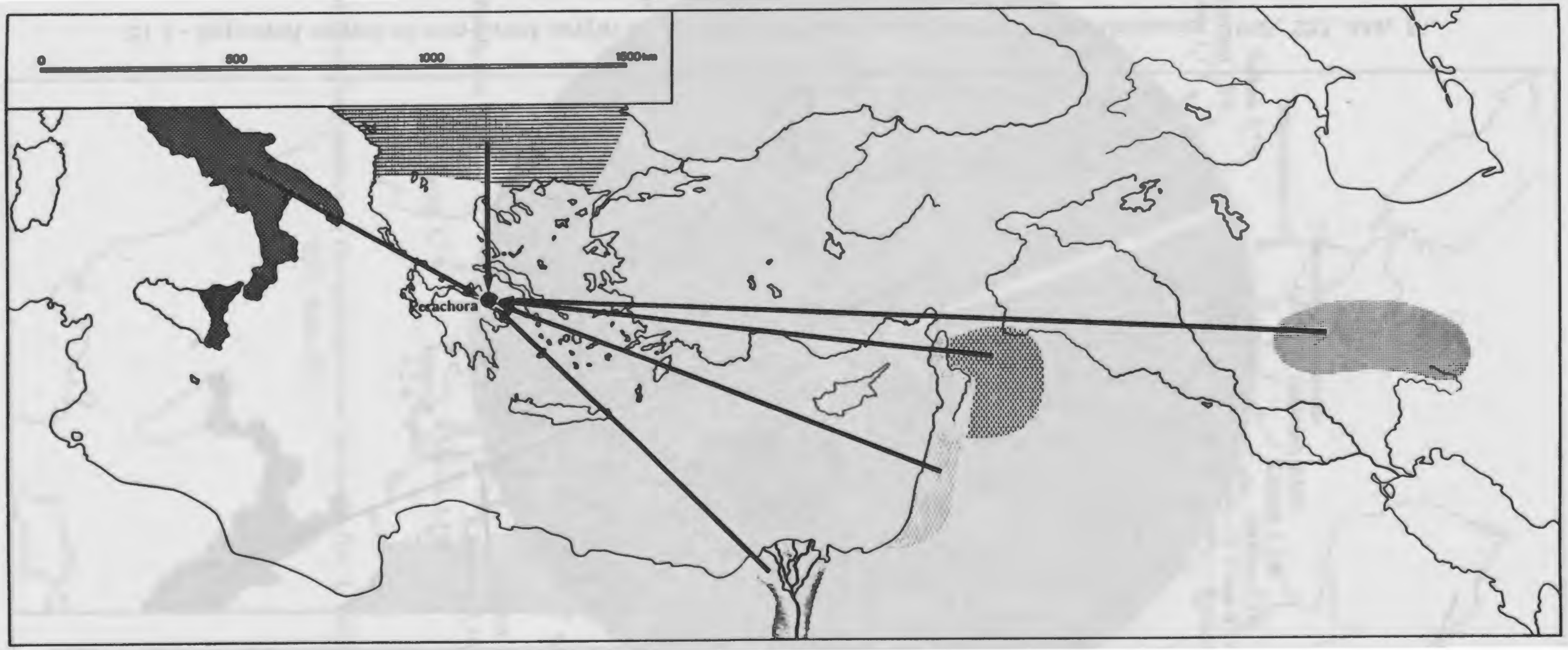

20.1 - distribution of imported votives in the sanctuary at Olympia (after I. Kilian-Dirlmeier, 1985, 231, Abb. 13).



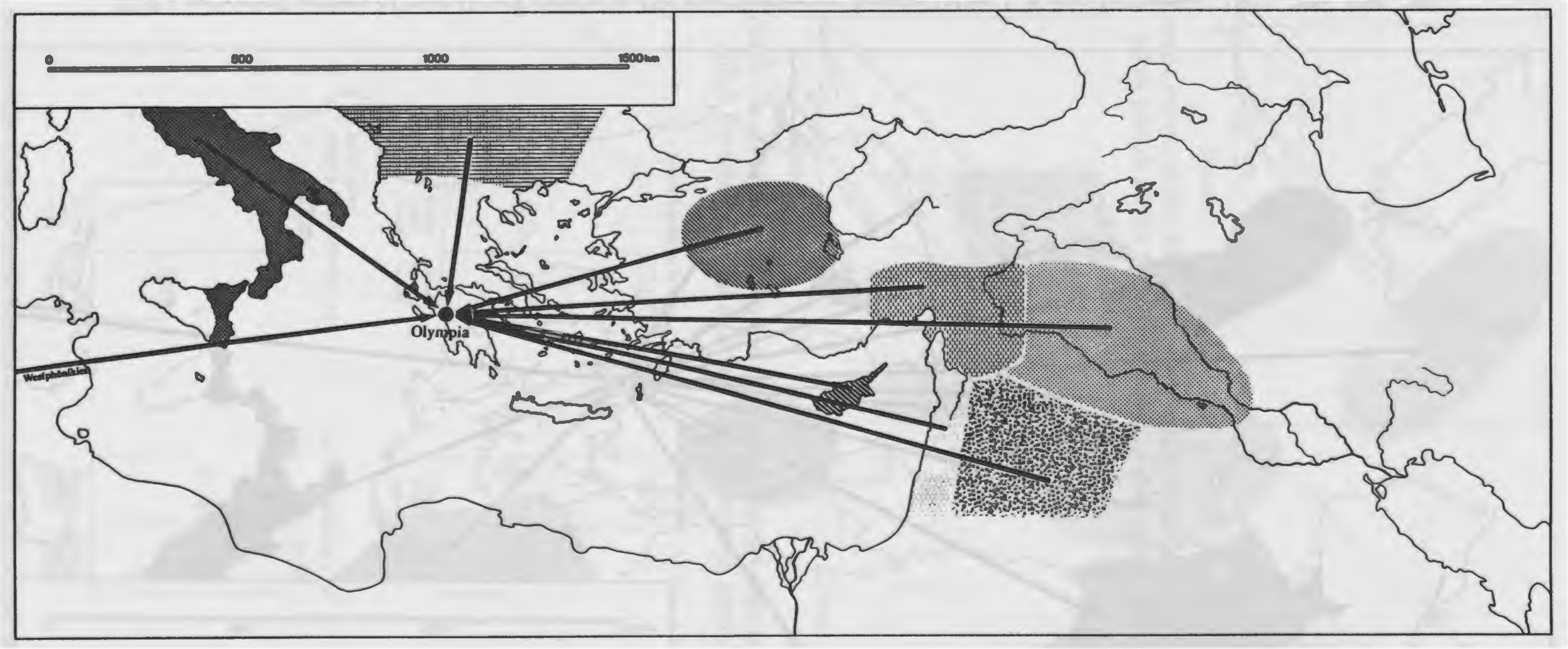

20.2 - distribution of imported votives in the sanctuary on Samos (after I. Kilian-Dirlmeier, 1985, 237, Abb. 18).



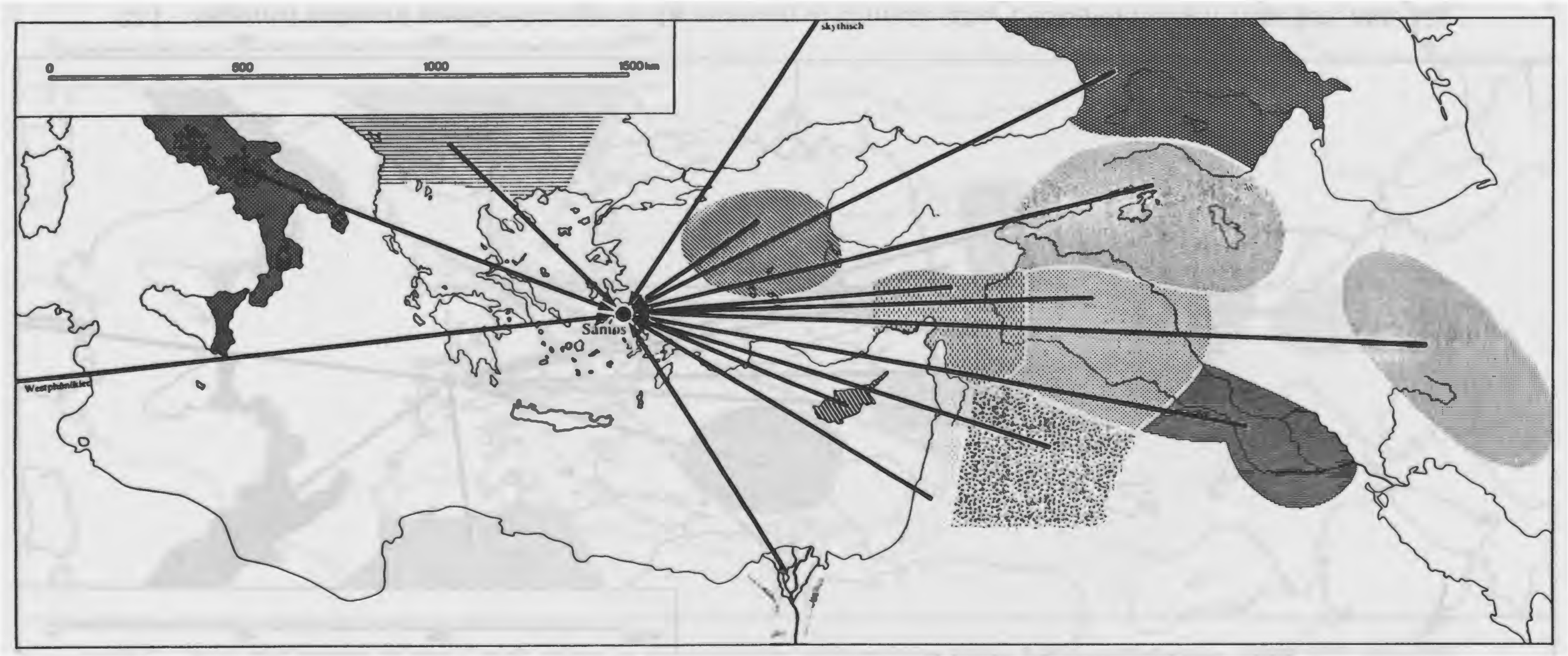

21.1 - imported votives of non-Greek origin in the sanctuary at Pherae (after I. Kilian-Dirlmeier, 1985, 223, Abb. 5).



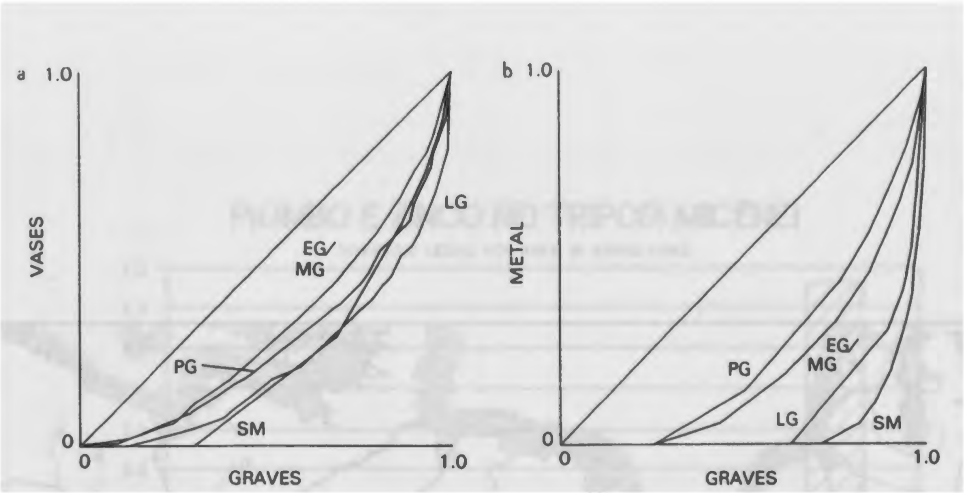

21.2 - imported votives of non-Greek origin in the sanctuary at Perachora (after I. Kilian-Dirlmeier, 1985, 227, Abb. 10).



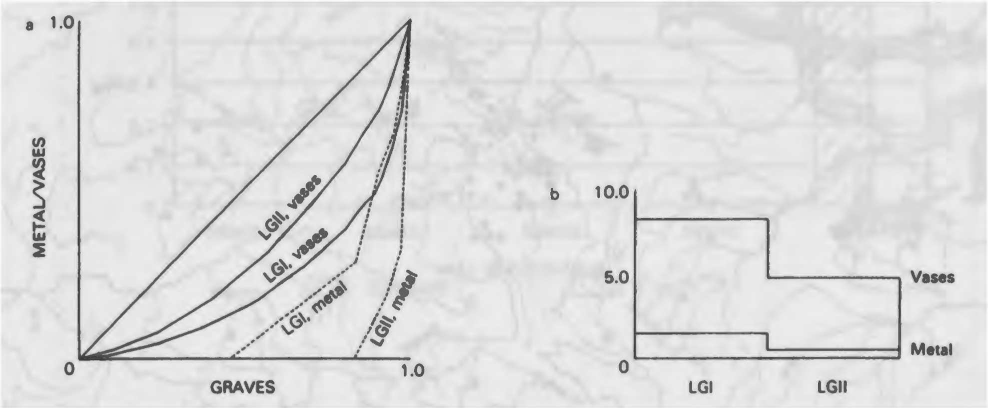

22.1 - imported votives of non-Greek origin in the sanctuary at Olympia (after I. Kilian-Dirlmeier, 1985, 233, Abb. 15).



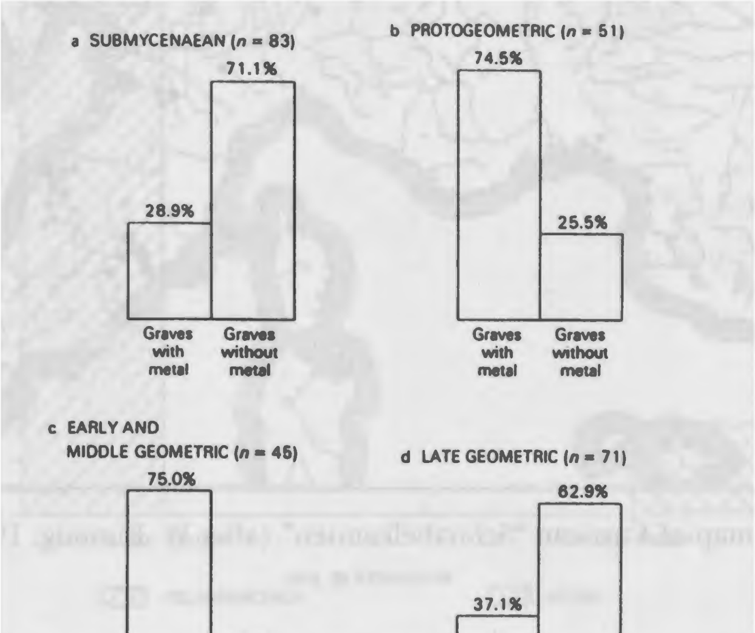

22.2 - imported votives of non-Greek origin in the sanctuaries on Samos (after I. Kilian-Dirlmeier, 1985, 239, Abb. 20).



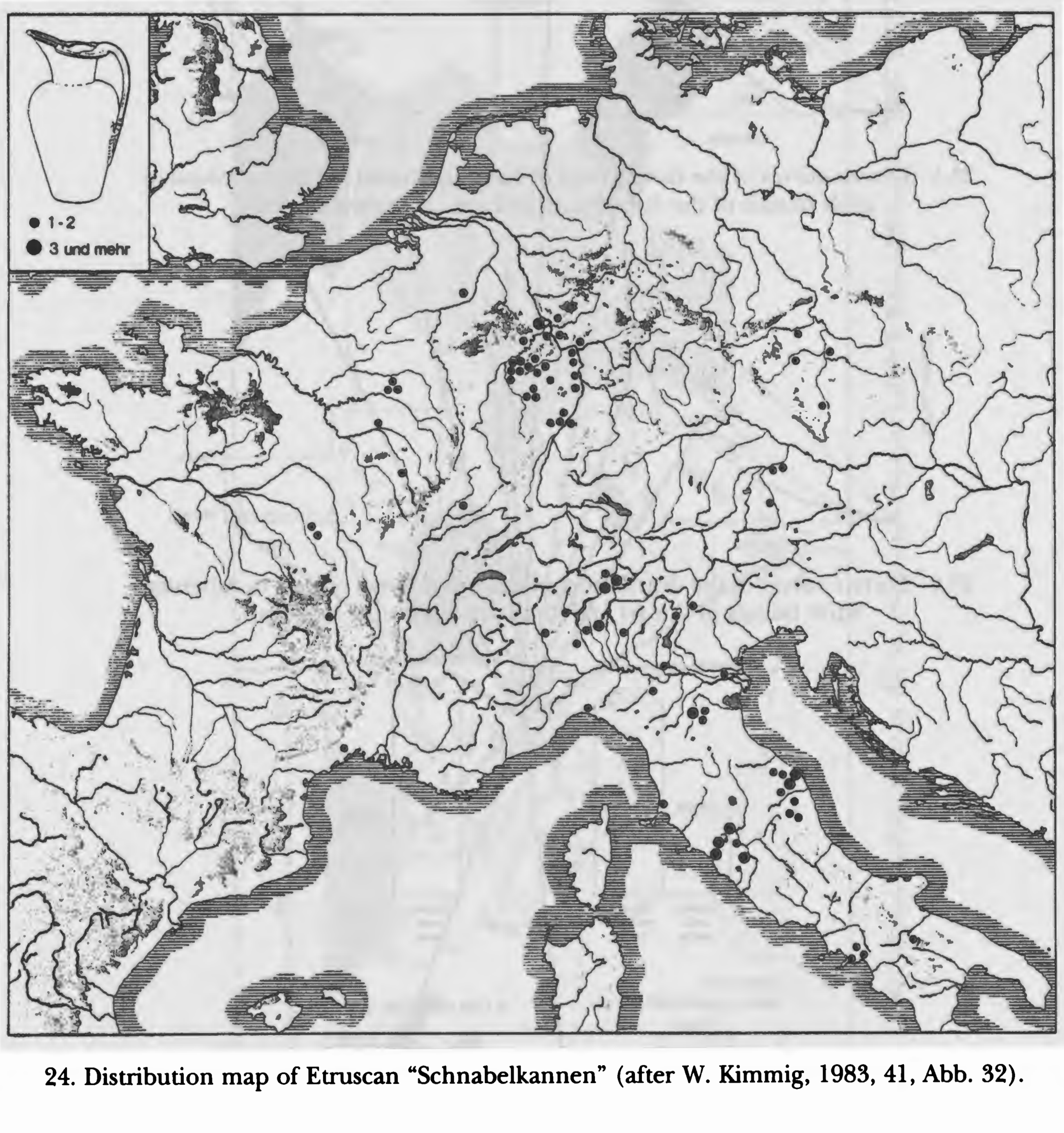

23.1 - Lorenz curves of the distribution of vases and metal objects in Athenian adult burials of the Sub-Mycenean-Late Geometric periods.



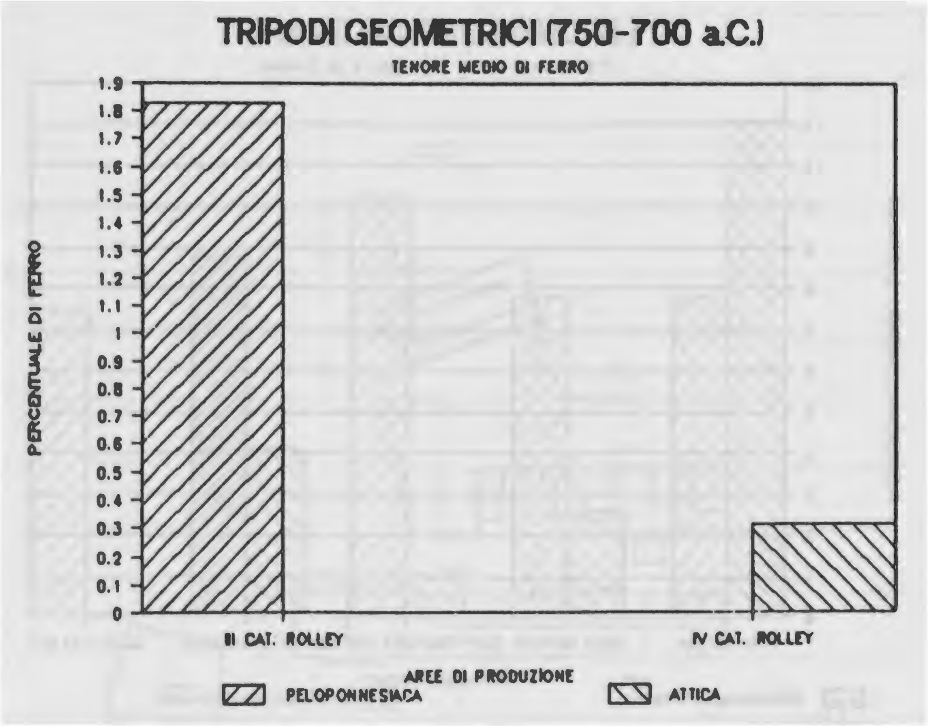

23.2 - Lorenz curves of the distribution of vases and metal objects in Athenian adult burials in the 1st and 2nd Late Geometric periods.



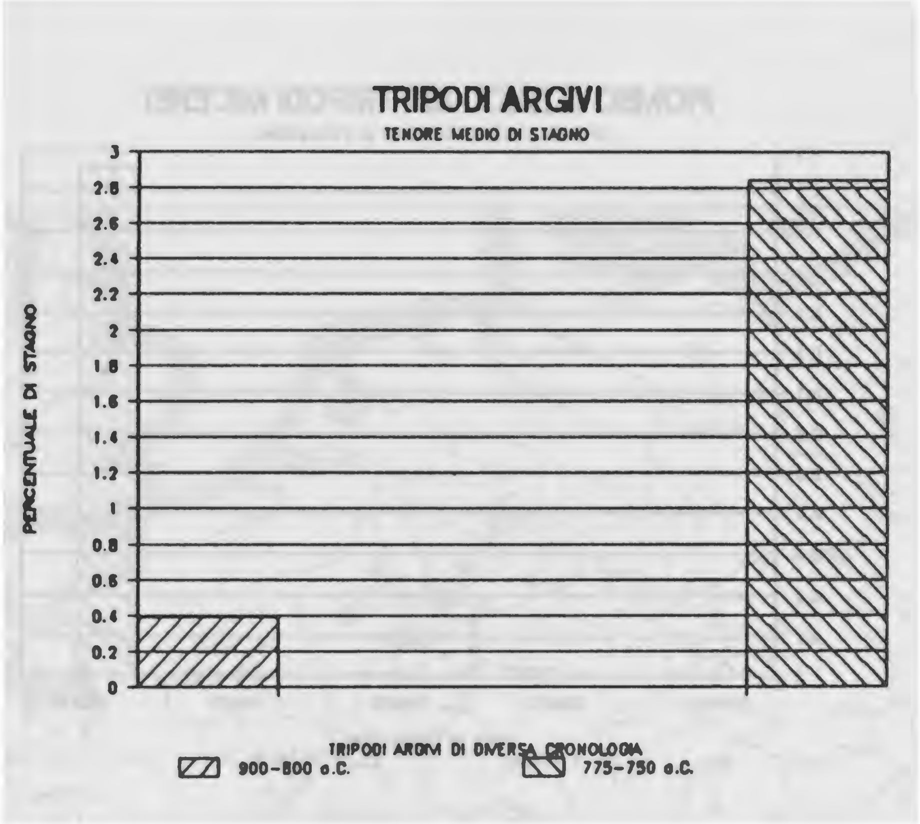

23.3 - proportion of intact adult burials with metal objects and without them in Athens (after I. Morris, 1987, 142, 143, 150, figs. 48-49, 53).



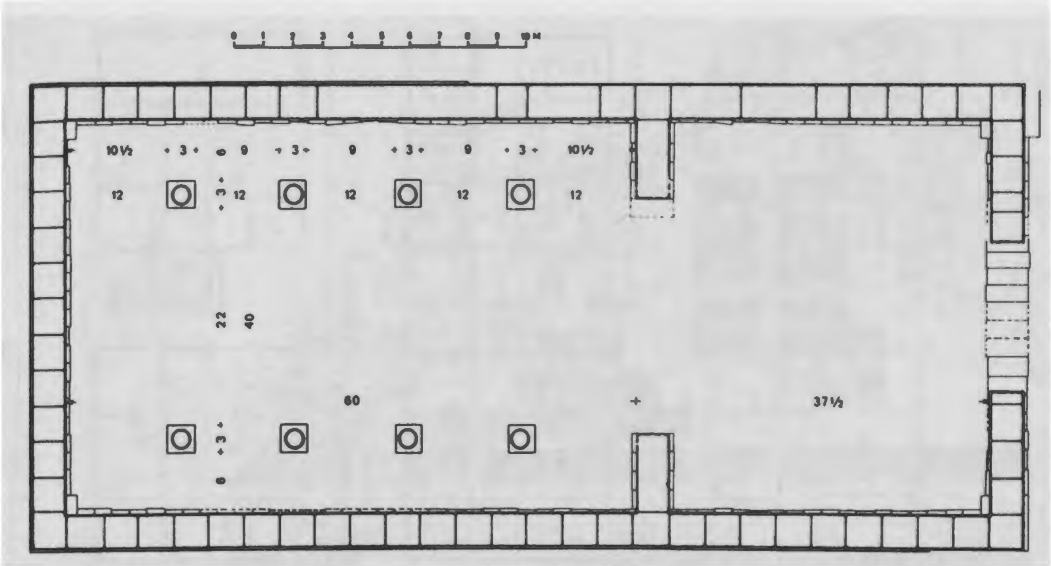

24. Distribution map of Etruscan "Schnabelkannen" (after W. Kimmig, 1983, 41, Abb. 32).



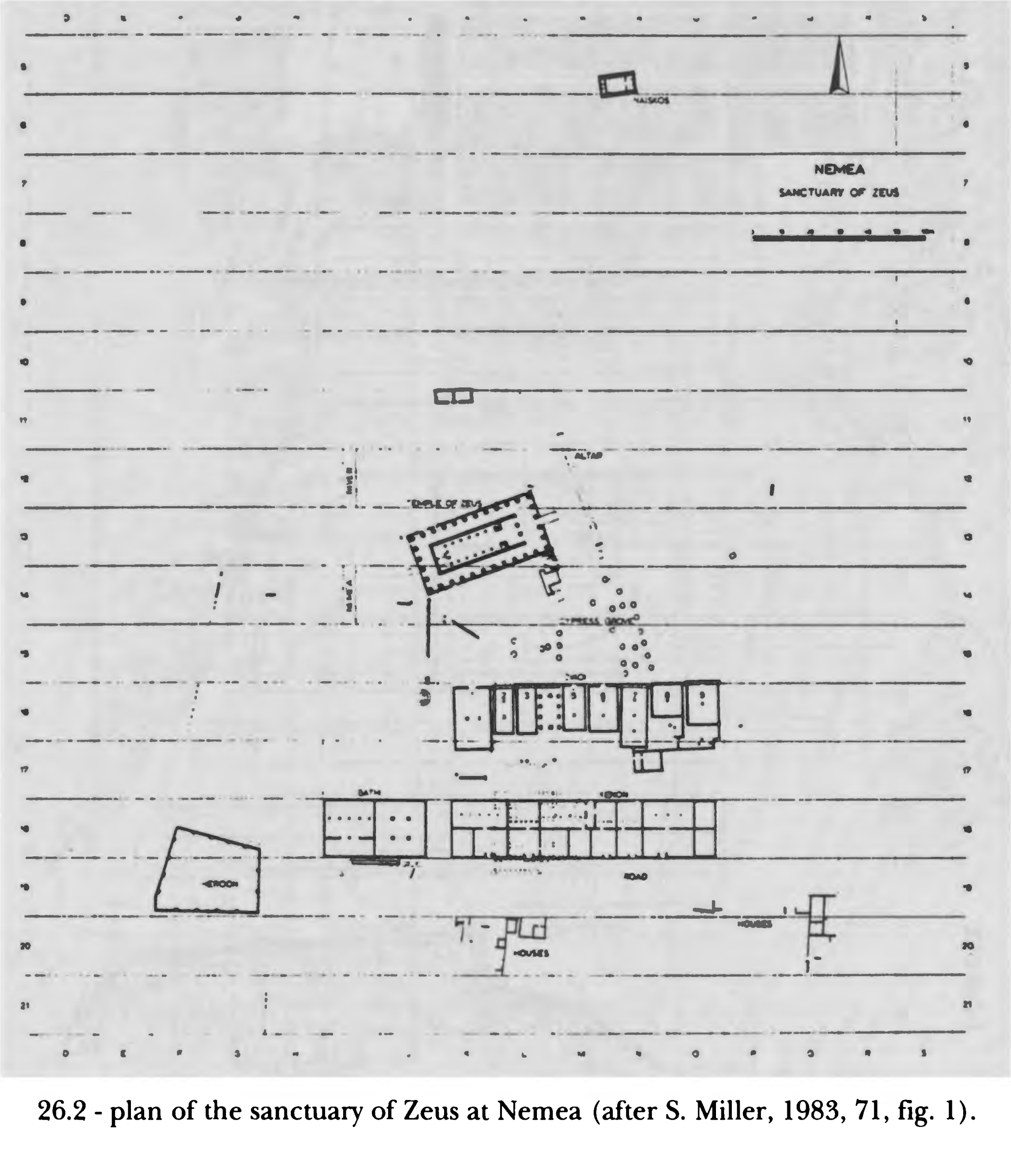

25.1-2 - histogrammes of metal analyses of Geometric bronzes
(after E.A. Sanpaolo, 1990, 119-120, figs. 44, 47).



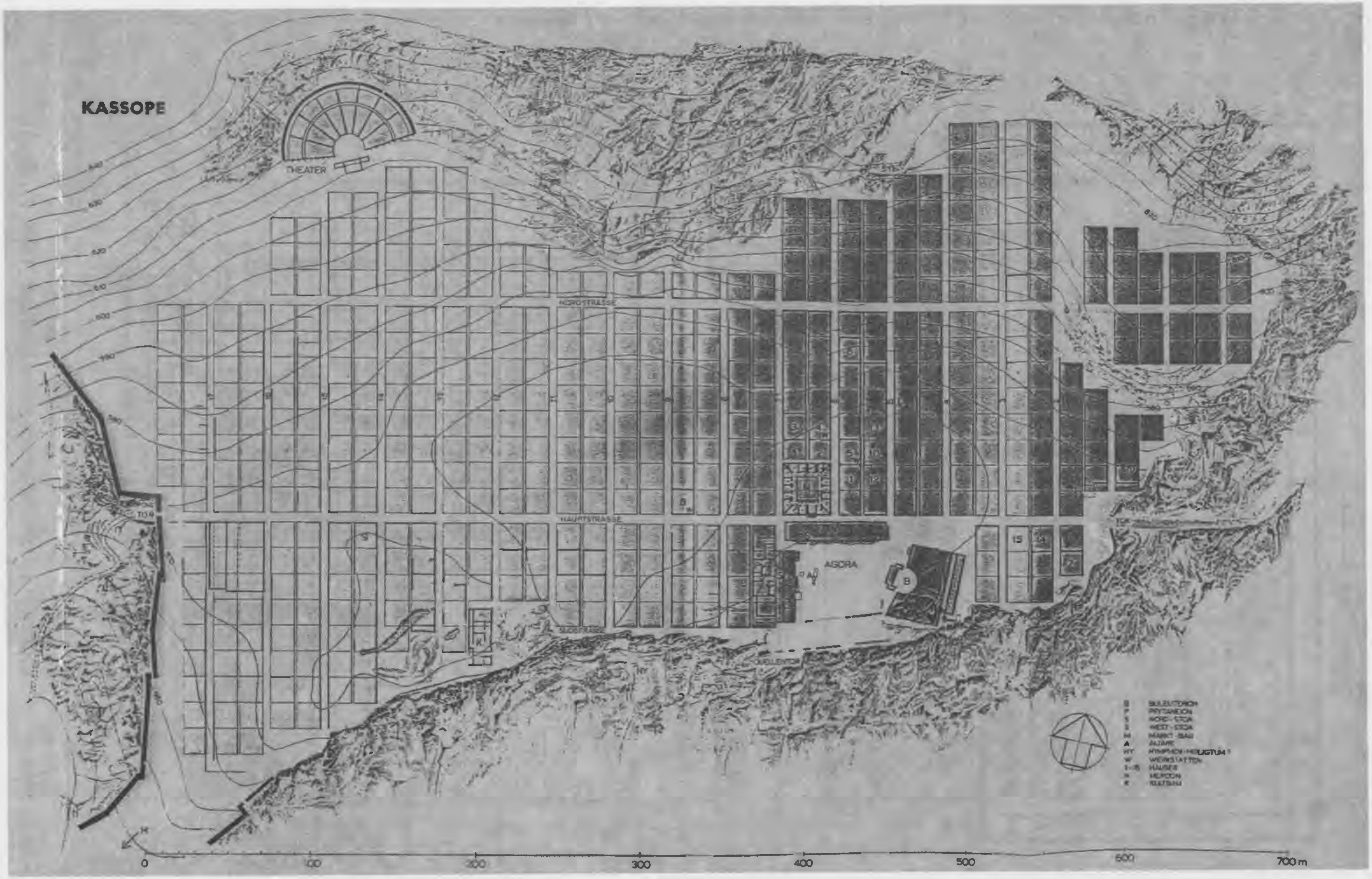
25.3-4 - histogrammes of metal analyses of Geometric bronzes (after E.A. Sanpaolo, 1990, 120-121, figs. 48, 50).



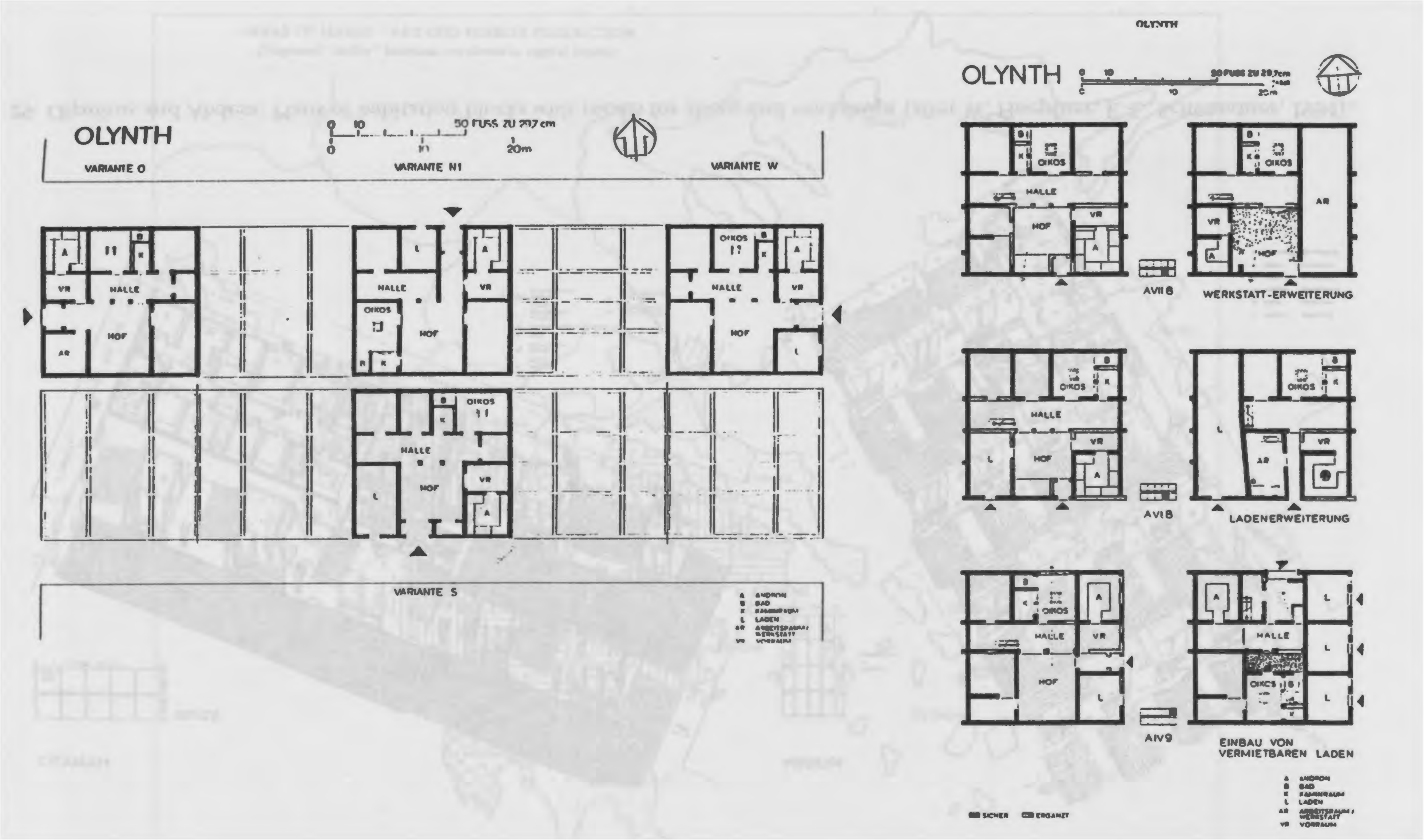
26.1 - plan of the workshop of Phidias at Olympia (after J. de Waele, 1988, 391, Abb. 2).



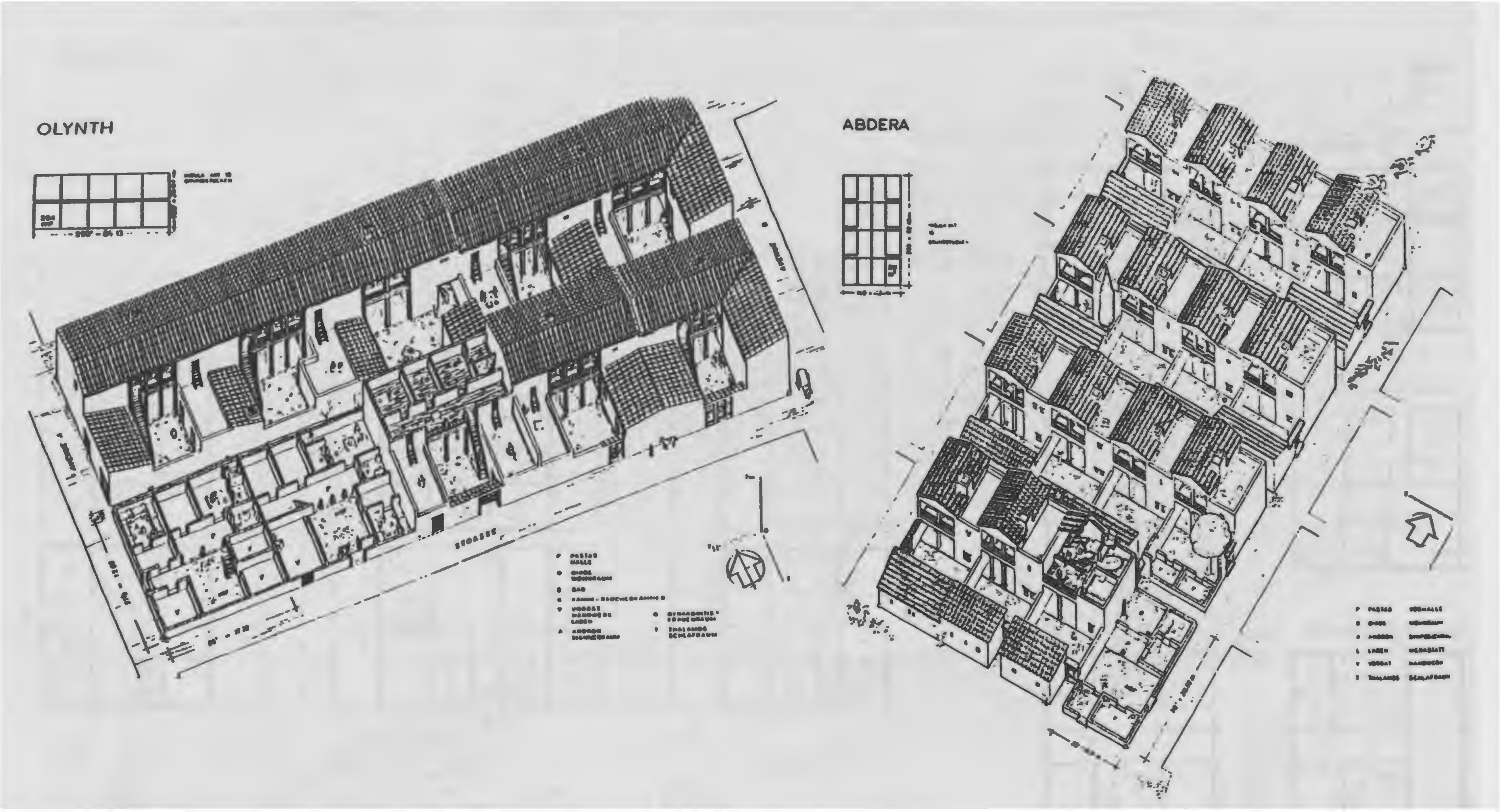

26.2 - plan of the sanctuary of Zeus at Nemea (after S. Miller, 1983, 71, fig. 1).




27. Cassope. Plan of the city with the Agora and public buildings (the Early Hellenistic period) (after W. Hoepfner, E.-L. Schwandner, 1994, Abb. 64).

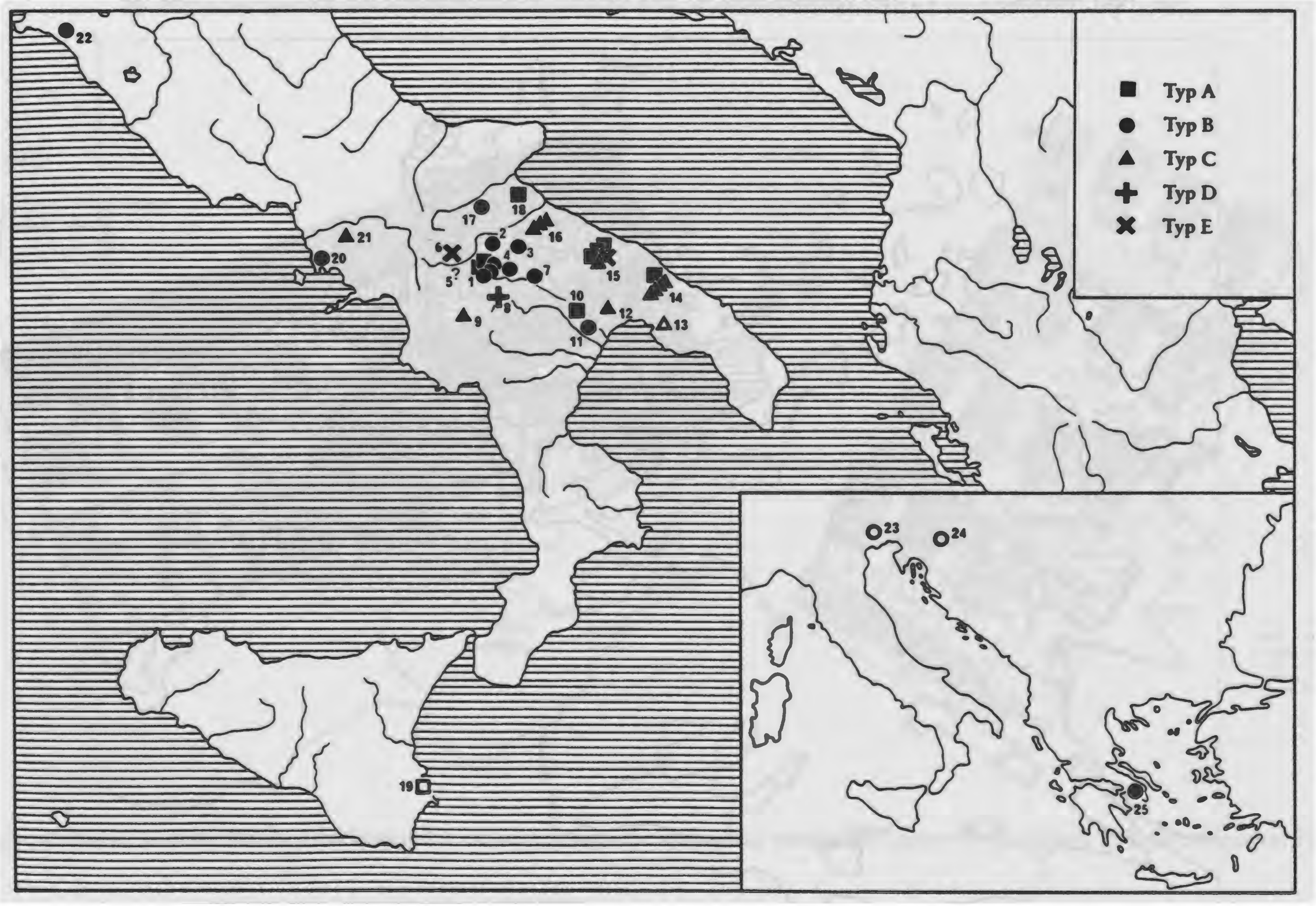



28. Olynthus. Plans of buildings with rooms for workshops (after W. Hoepfner, E.-L. Schwandner, 1994).

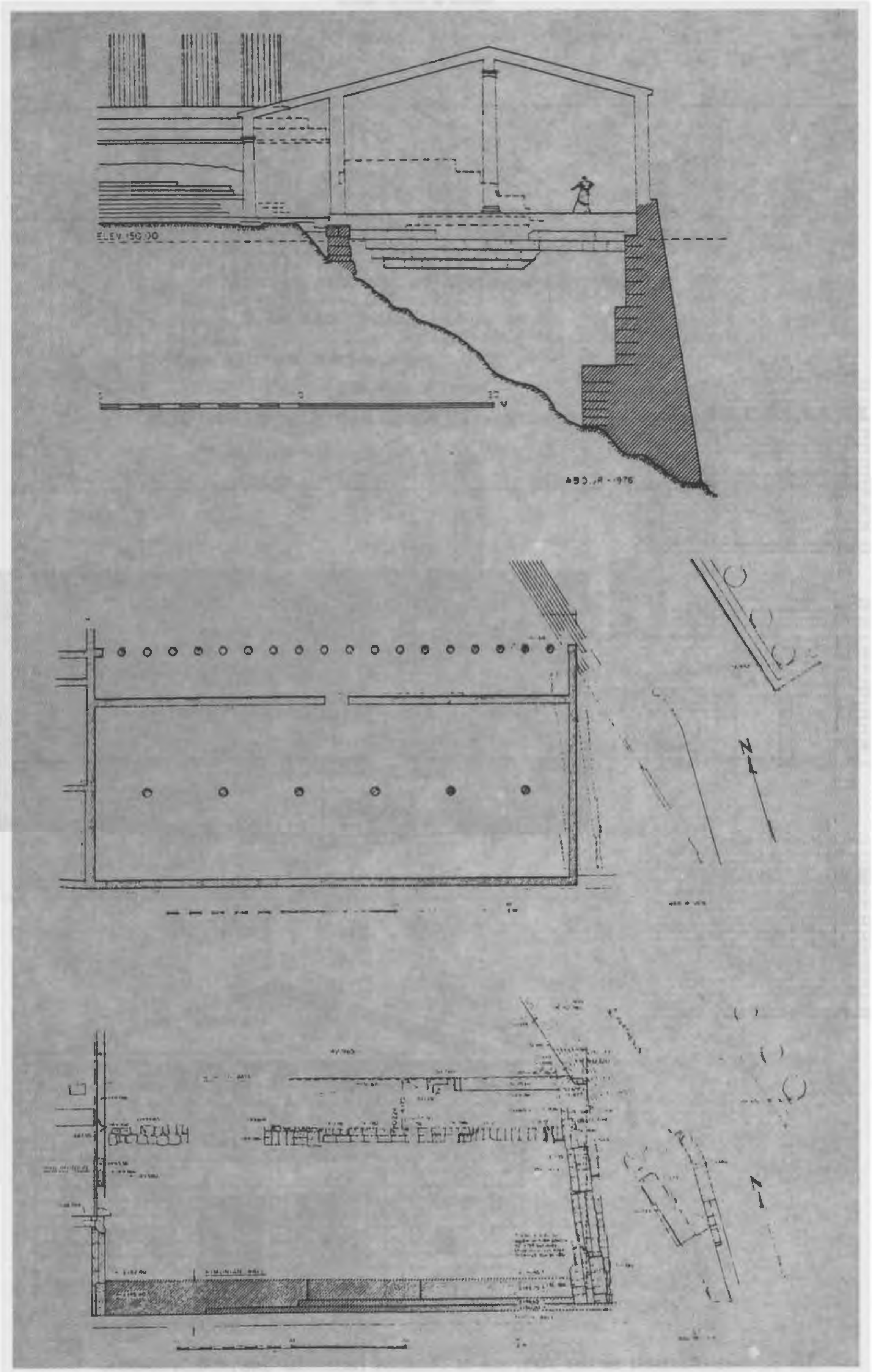



29. Olynthus and Abdera. Plans of habitation blocks with rooms for shops and workshops (after W. Hoepfner, E.-L. Schwandner, 1994).

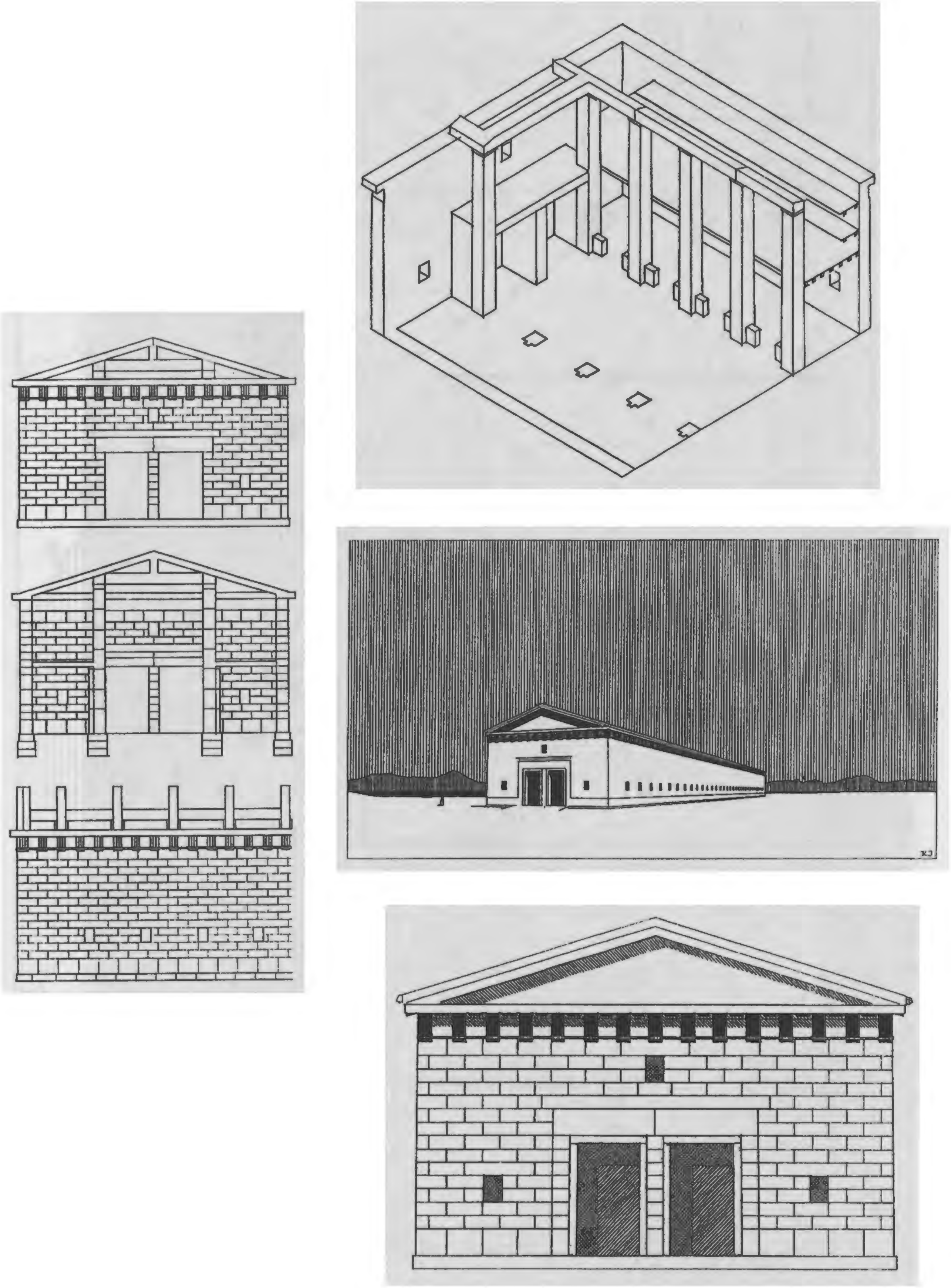
30. Major centres for the manufacture of mirrors with caryatid handles (after L.O. Congdon, 1981, 45).



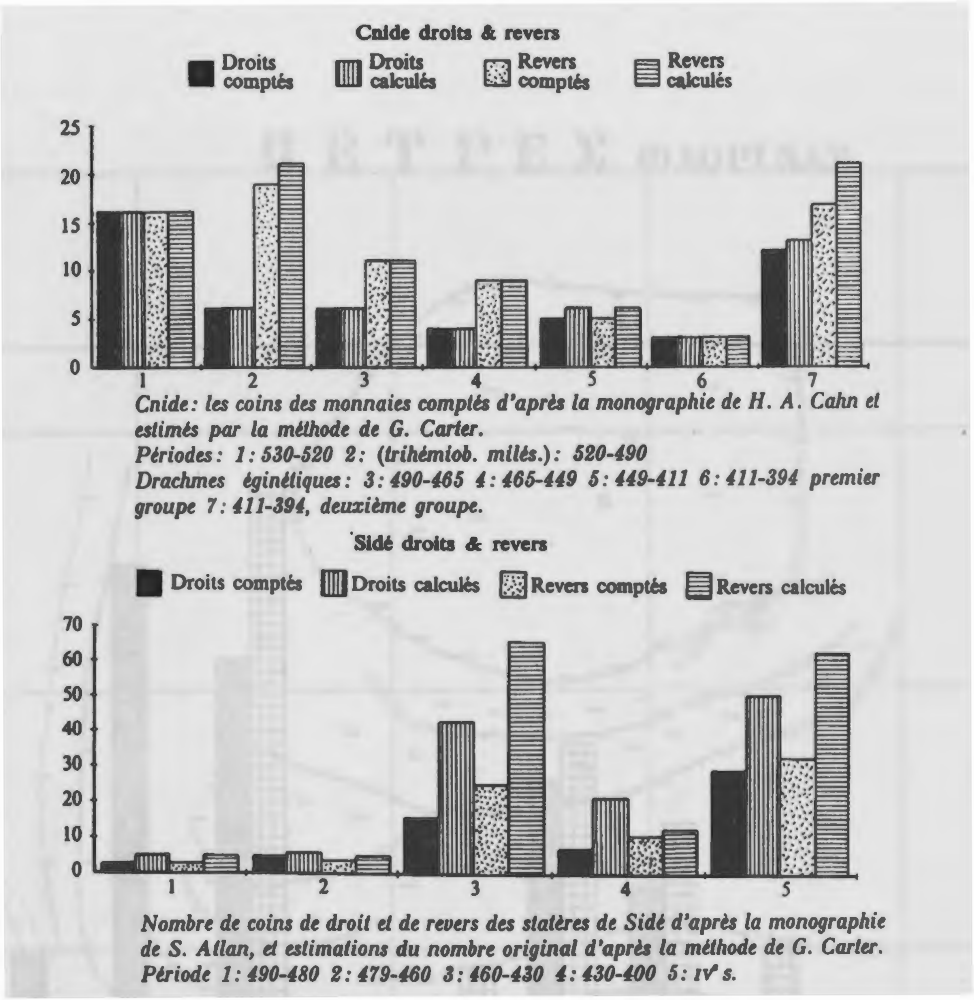

31. Distribution map of Apulo-Corinthian helmets (after A. Bottini, 1988, 110, Abb. 3).



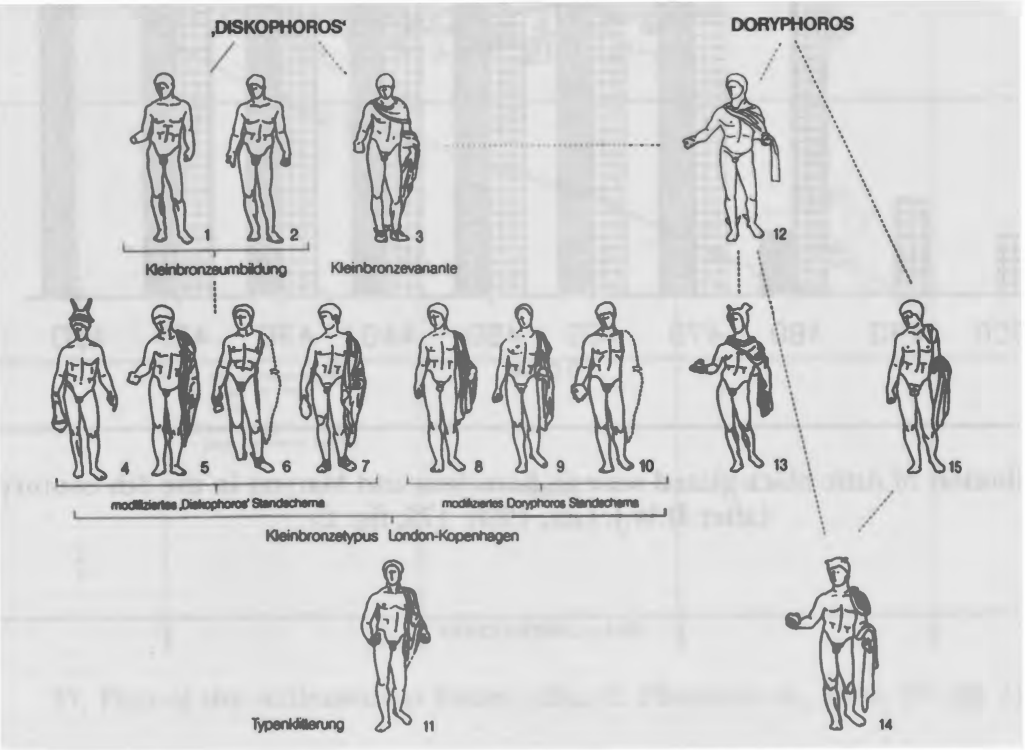
32. Reconstruction and plan of the Athenian Chalkotheke (ca. 370 B.C.)
(after L. La Follette, 1986, 84-85, figs. 3 -4).



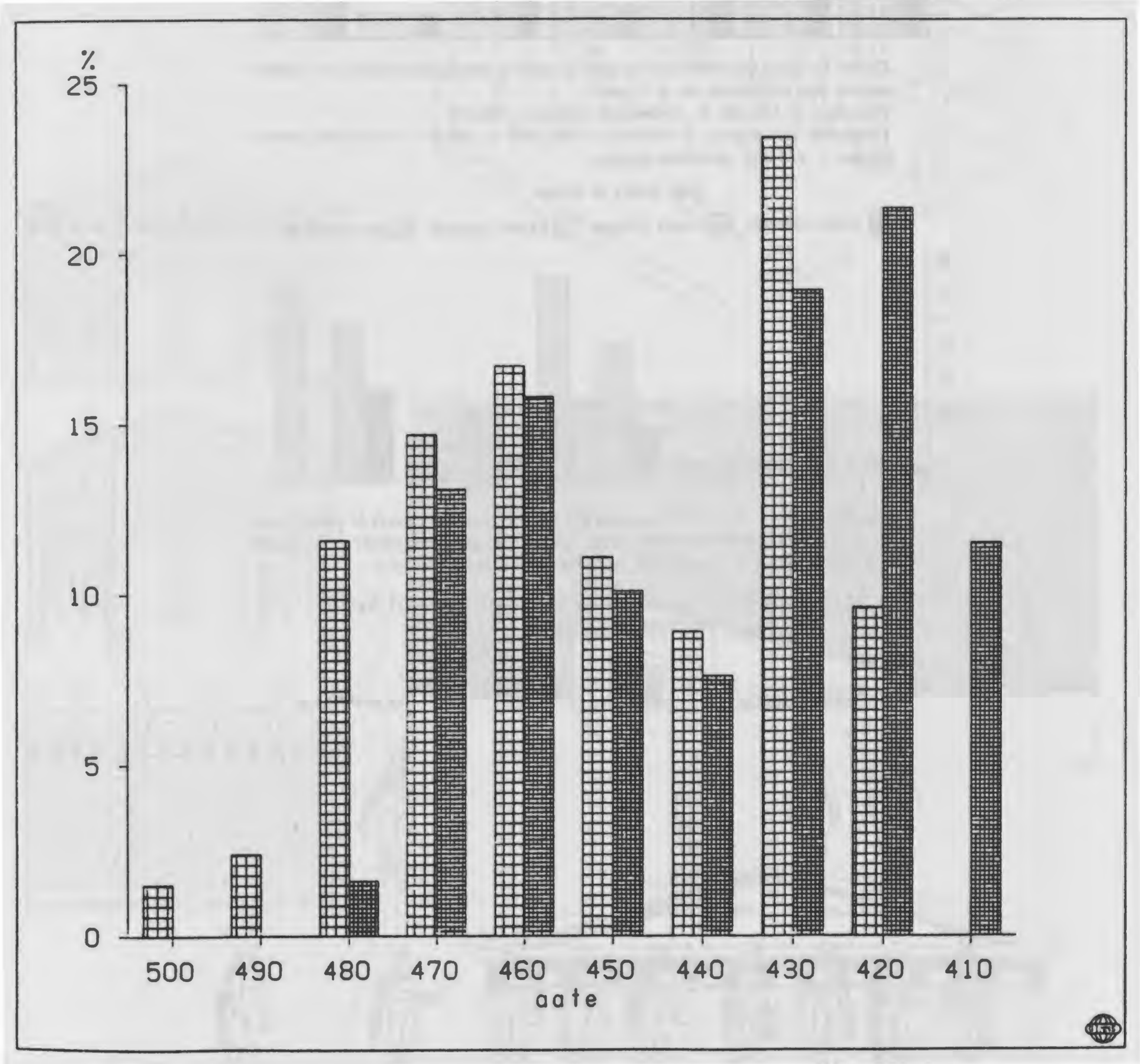
33. Reconstruction of the Arsenal at Piraeus (after K. Jeppesen, 1958).




34. Dynamics of coin issues of Cnidus and Syde
(after T. Hackens, 1987, figs. 2-3).



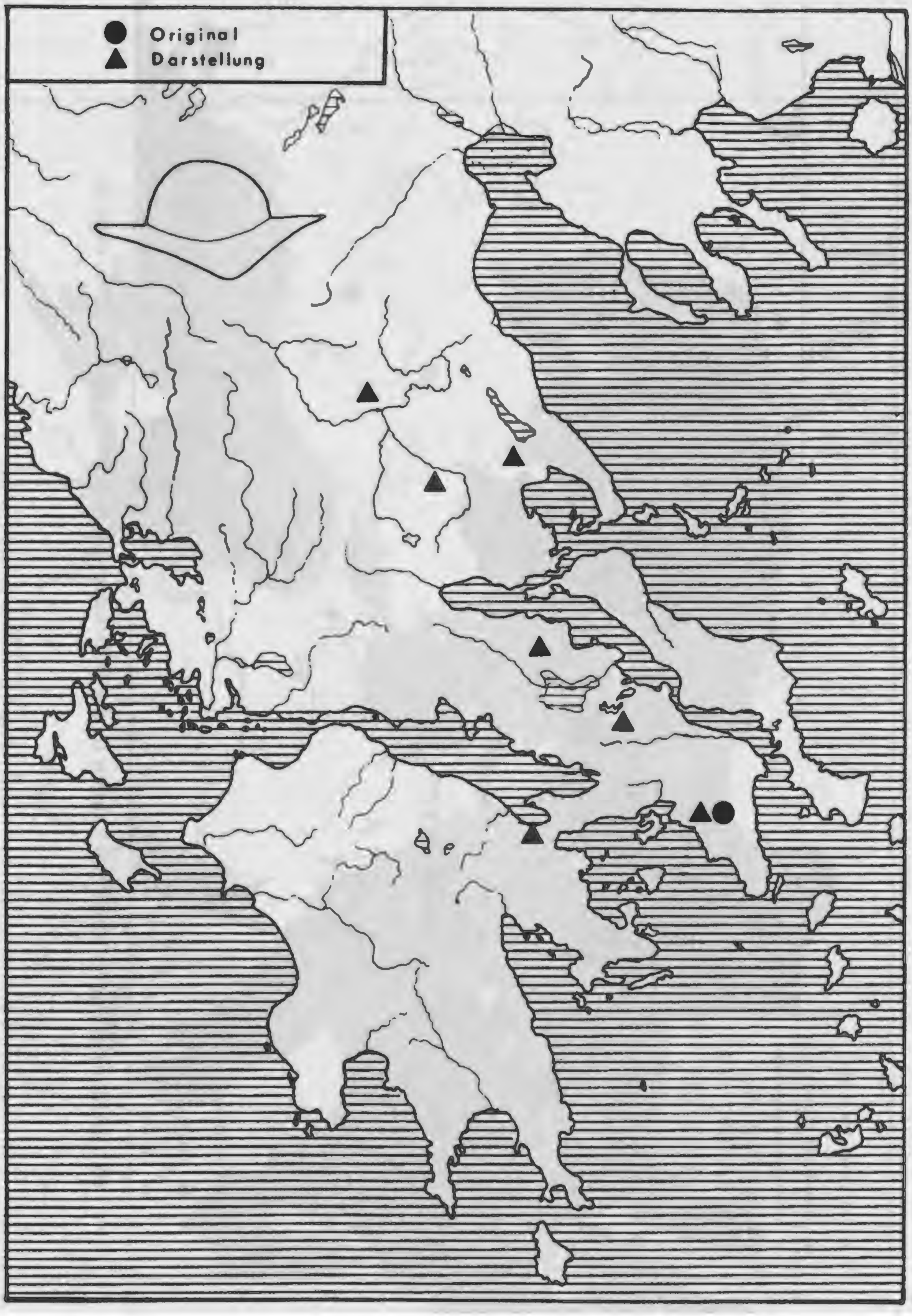

35. Polyclitan traditions in the Late Hellenistic and Roman bronze statuettes
(after A. Leibundgut, 1990, 398, Abb. 238).



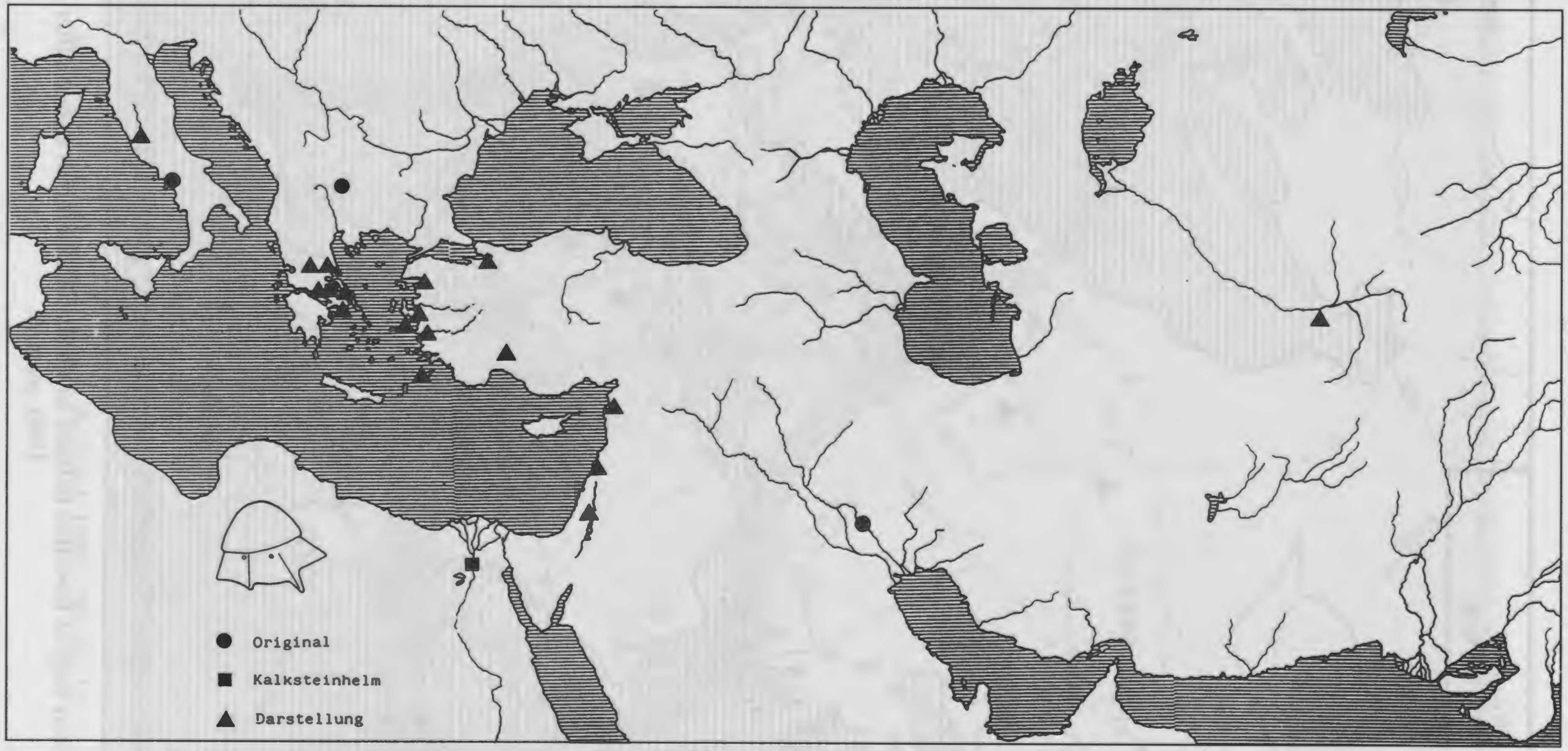

36. Distribution of Attic black-glazed ware in Kameiros and Maryon in the 5th century B.C. (after D.W.J. Gill, 1988, 179, fig. 2).

37. Plan of the settlement at Petres (after E. Photos et al., 1988, 37, fig. 1).

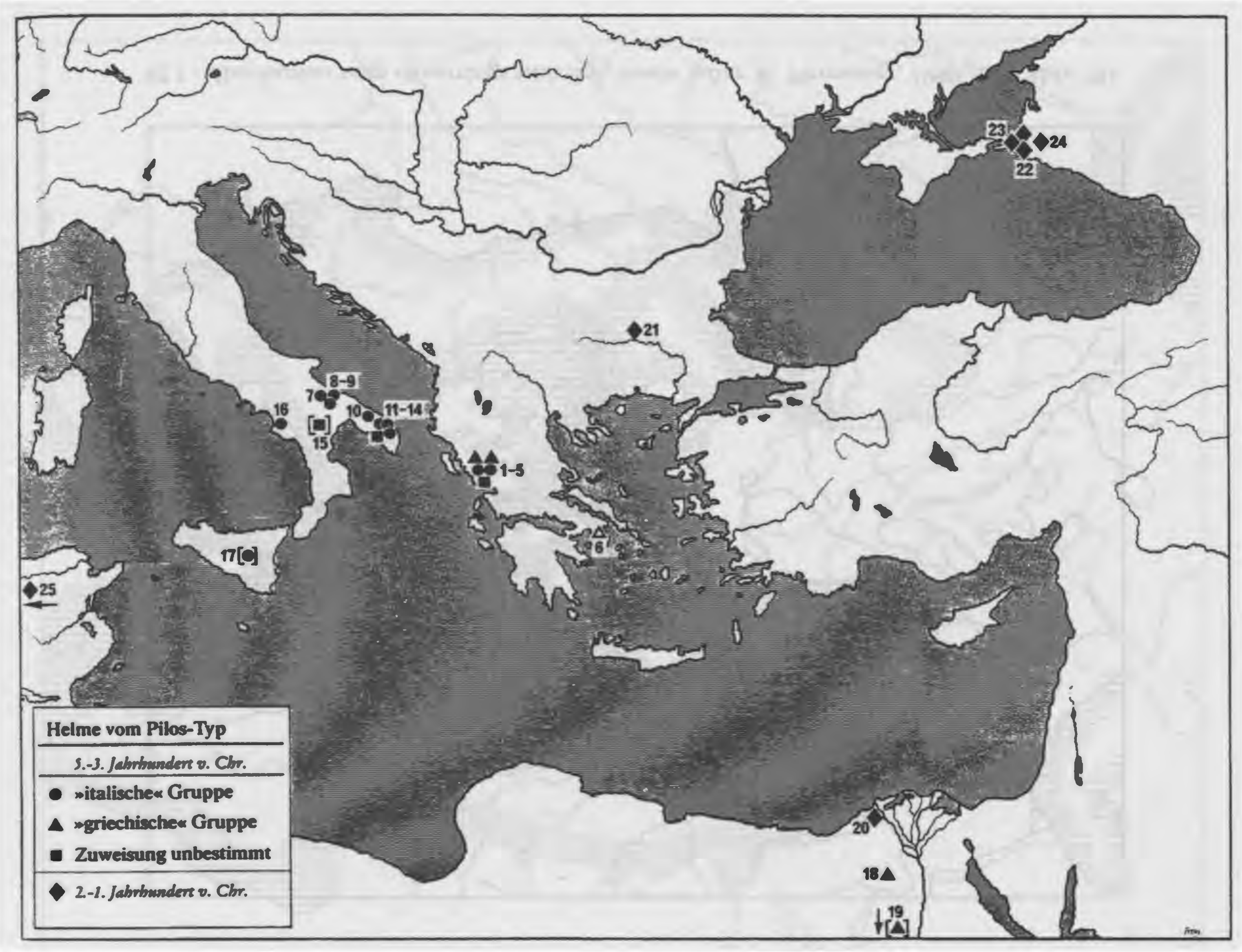
38. Plan of Aï-Khanoum (after P. Bernard, 1980, 436, fig. 1).



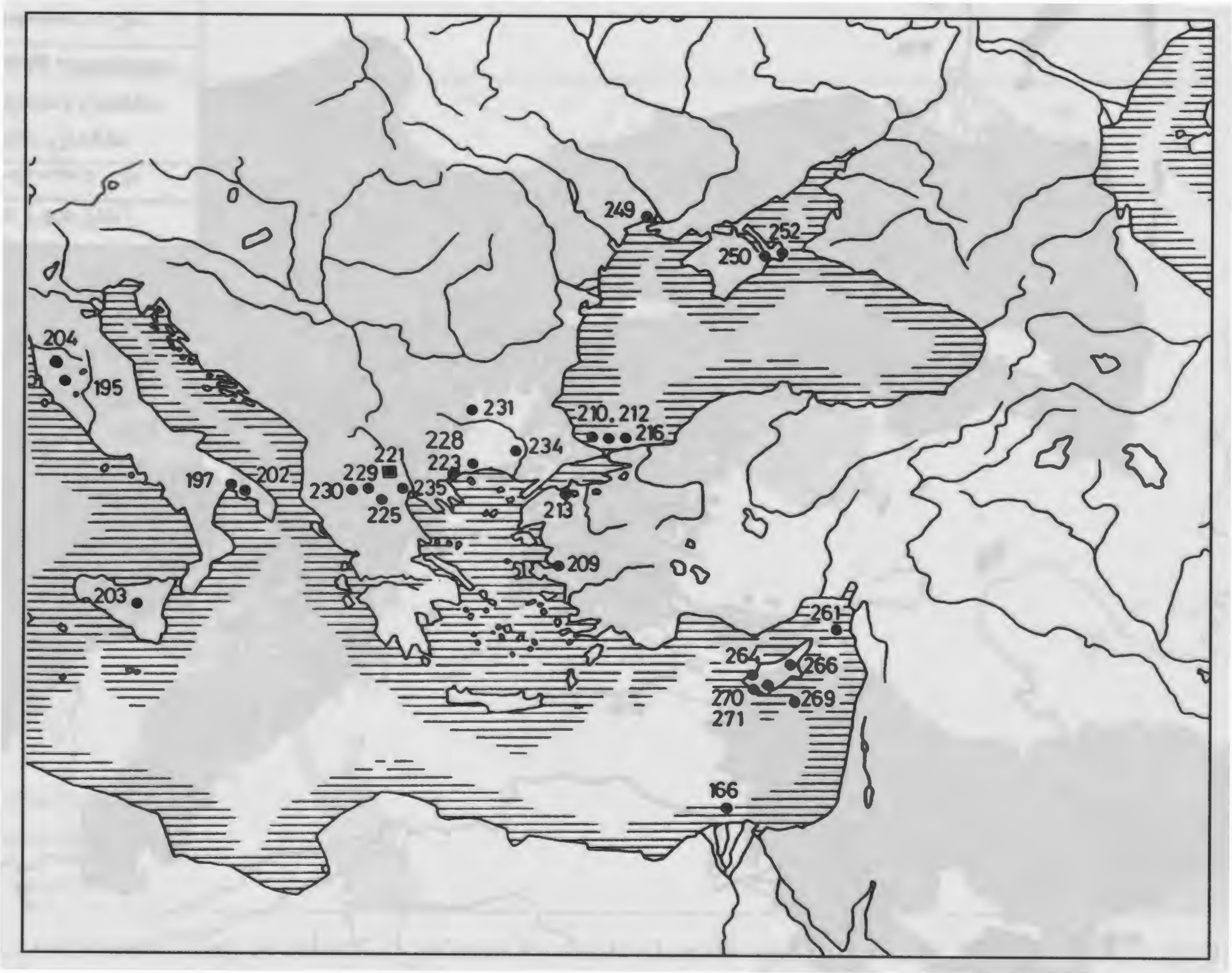

39. Distribution map of Boeotian helmets in the Pre-Alexandrian epoch (after P. Dintsis, 1986, map 1).



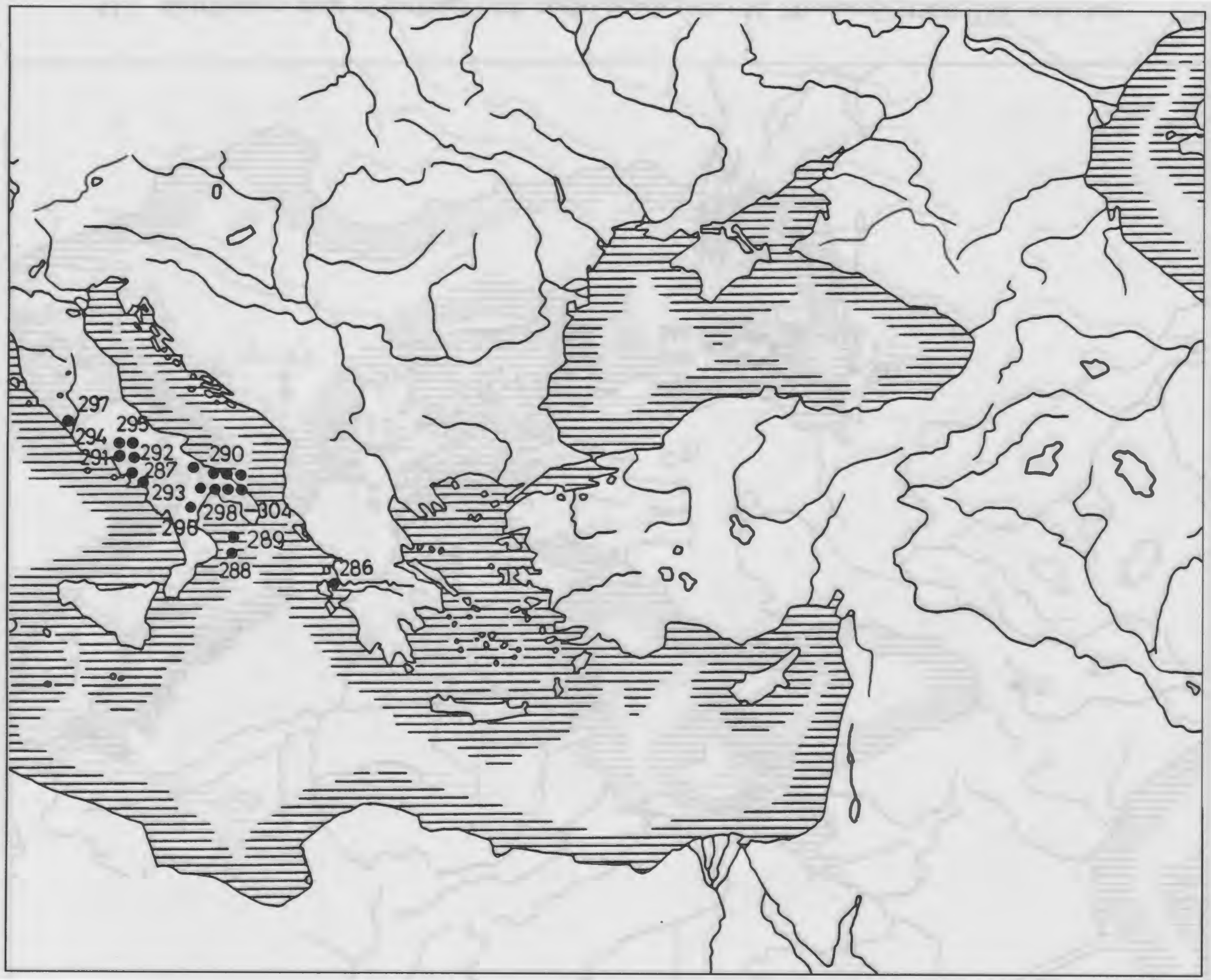

40. Distribution map of Boeotian helmets in the Hellenistic epoch (after P. Dintsis, 1986, map 2).



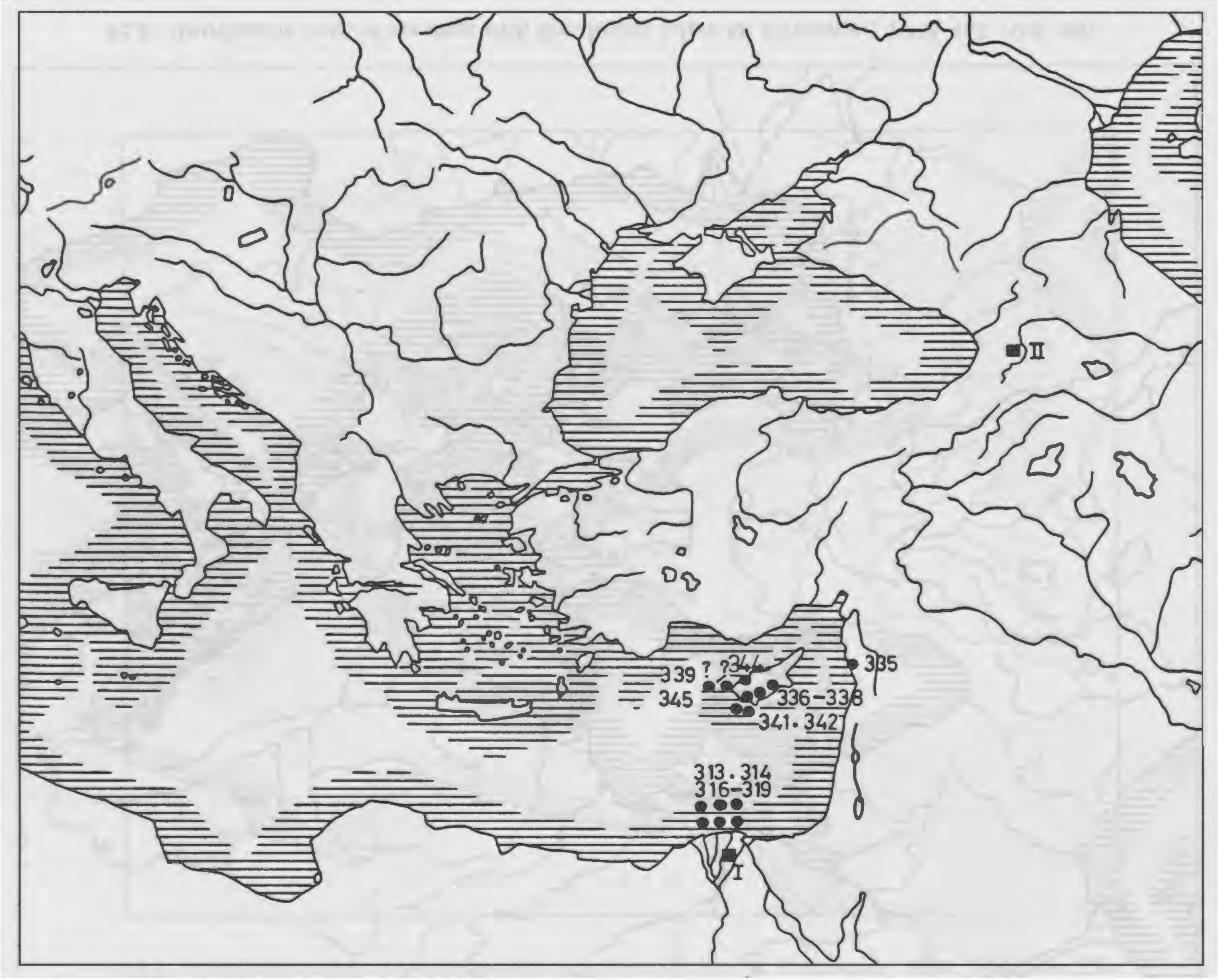

41. Distribution map of Pylos-type helmets (after G. Waurick, 1988, 153, Abb. 2).




42.1 - distribution map of earrings with lion heads (after M. Pfrommer, 1990, 148, Abb. 23).




42.2 - distribution map of earrings with lion heads (after M. Pfrommer, 1990, 155, Abb. 26).

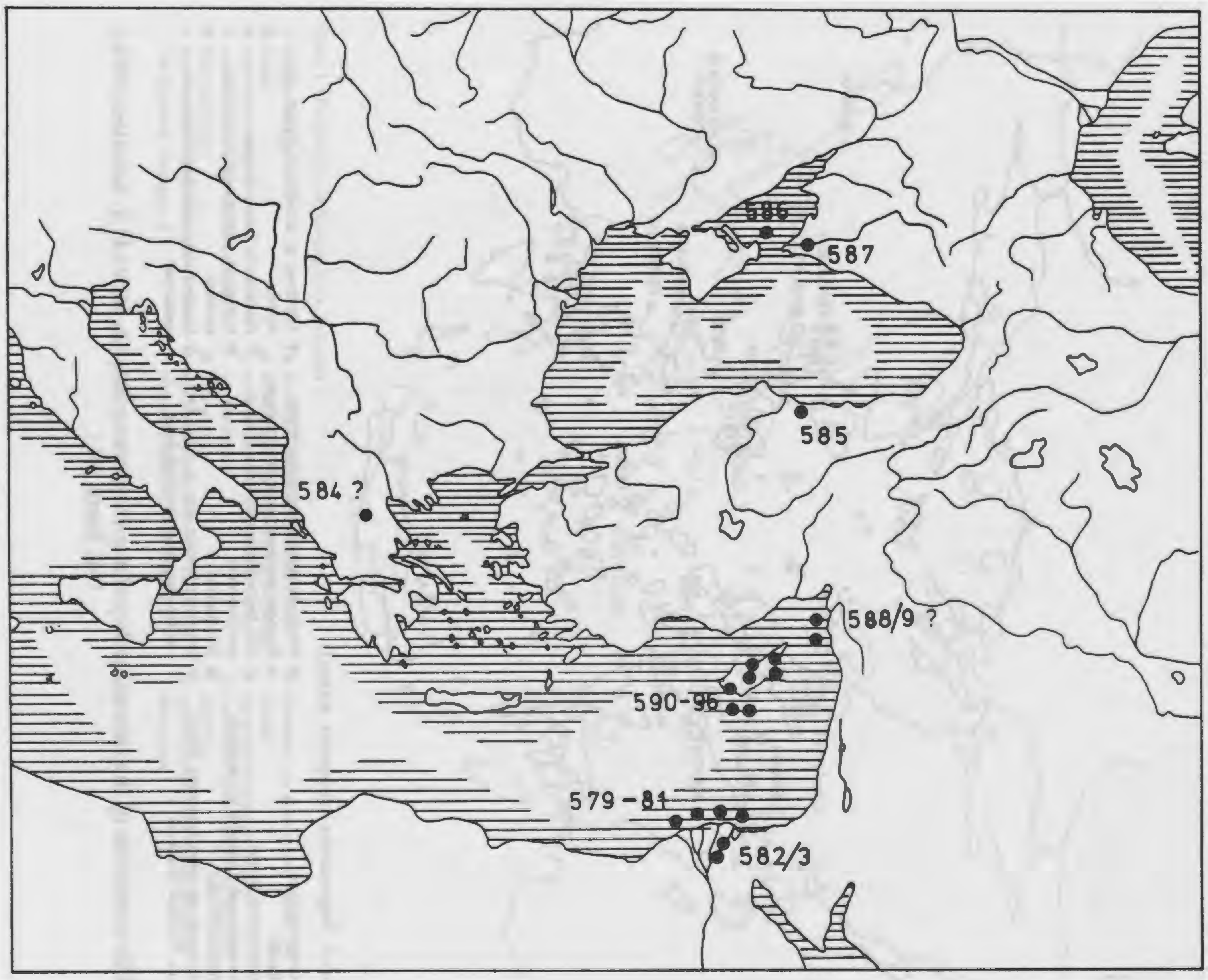



43.1 - distribution map of earrings with negro heads (after M. Pfrommer, 1990, 186, Abb. 36).

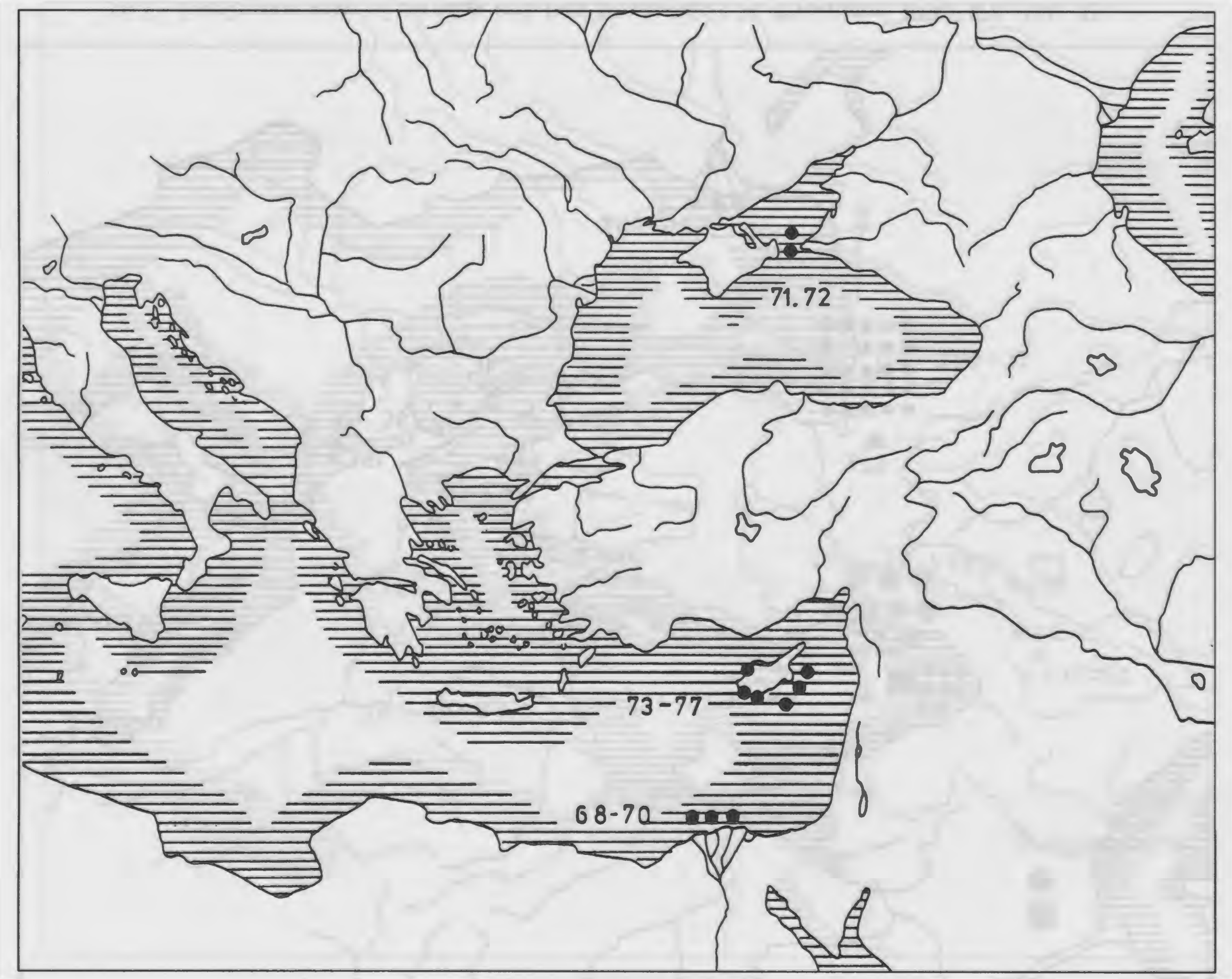
43.2 - distribution map of earrings with lion-griffins heads of the Ptolemaic type (after M. Pfrommer, 1990, 158, Abb. 27).

44.1 - directions of the cultural policy of the Pergamene Attalids (after H.-J. Schalles, 1985, 151, Karte 2).

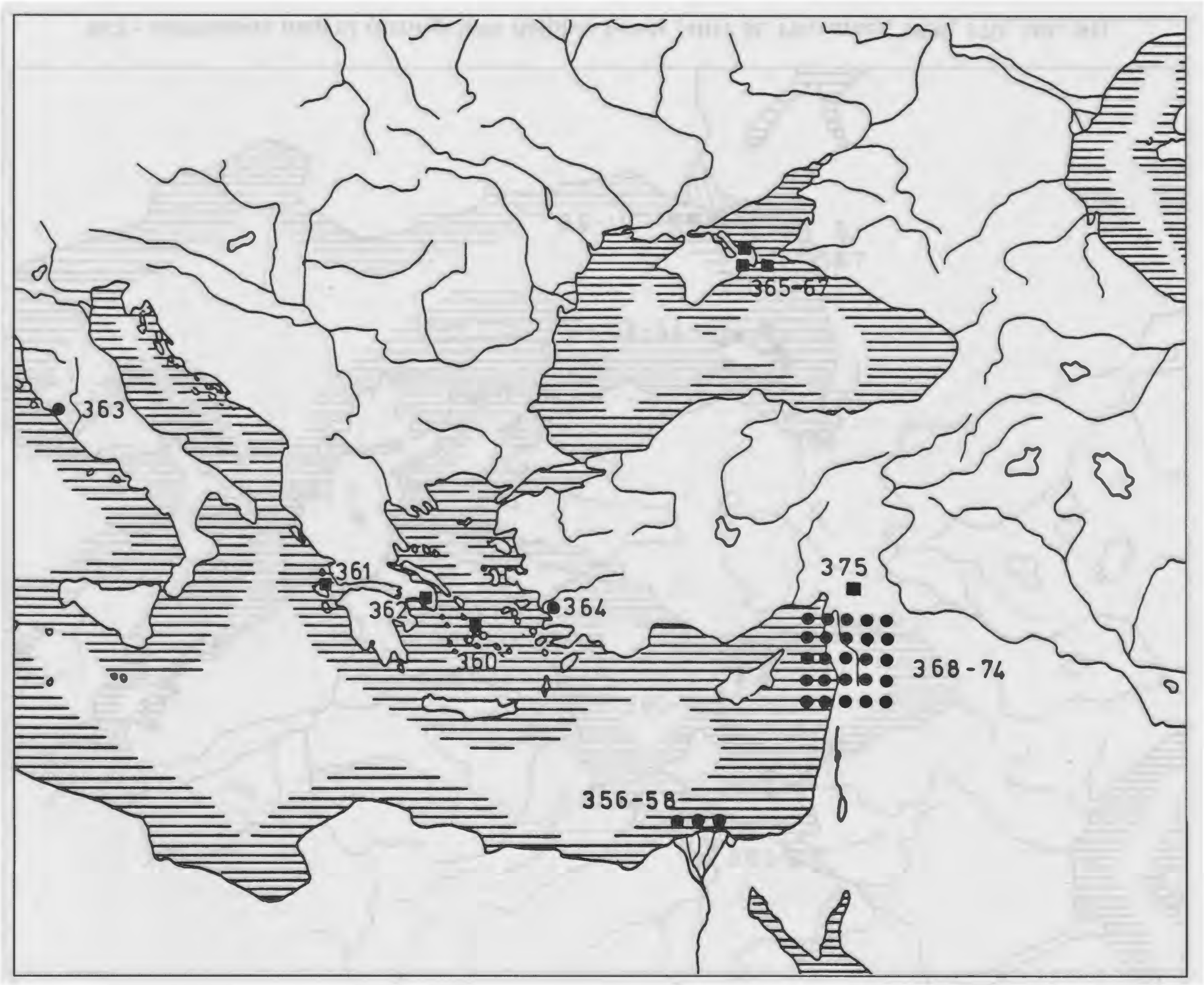
44.2 - directions of the cultural policy of the Pergamene Attalids (after H.-J. Schalles, 1985, 152, Karte 3).



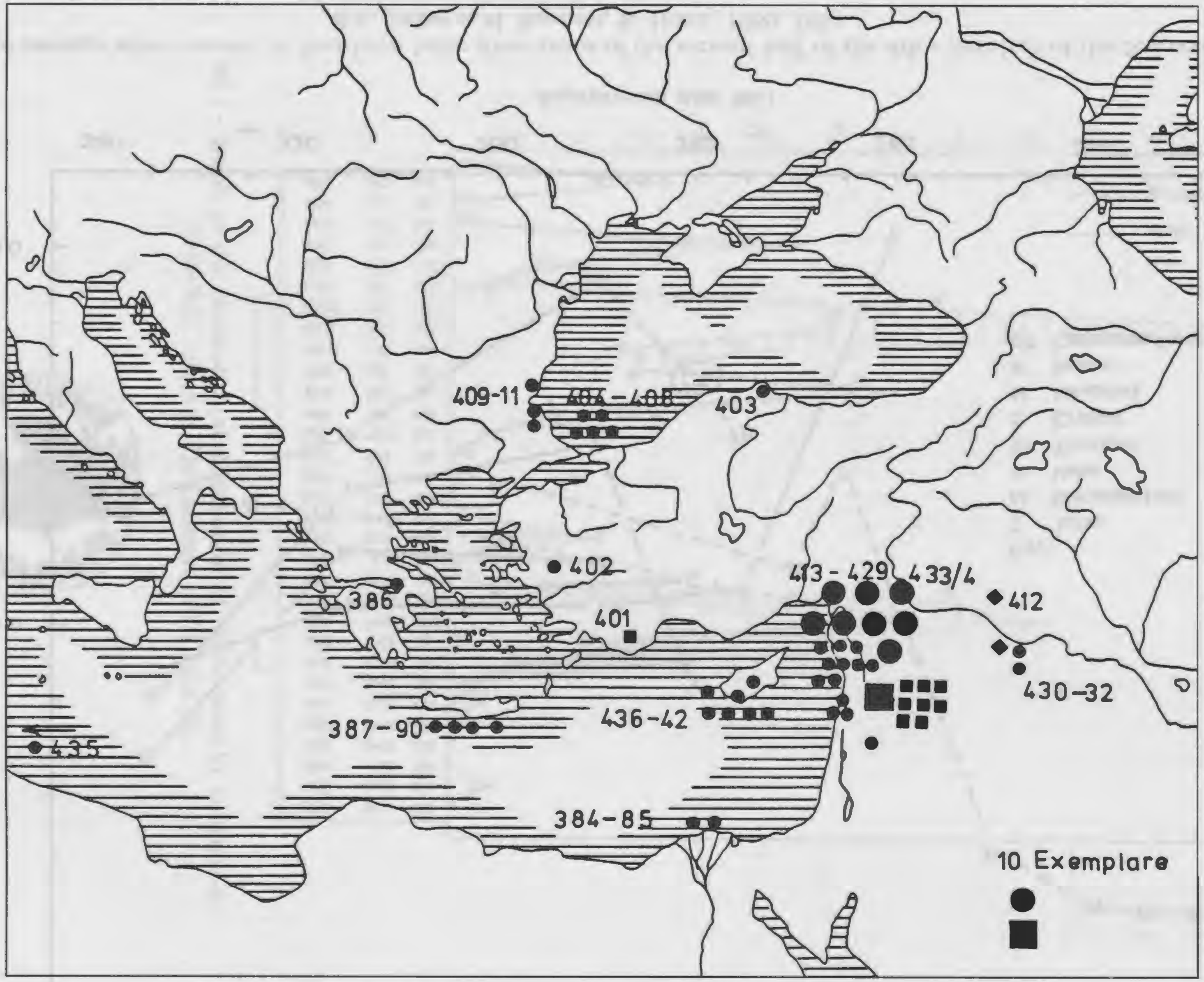

45.1 - distribution map of earrings with she-goats and ram heads (after M. Pfrommer, 1990, 173, Abb. 32).



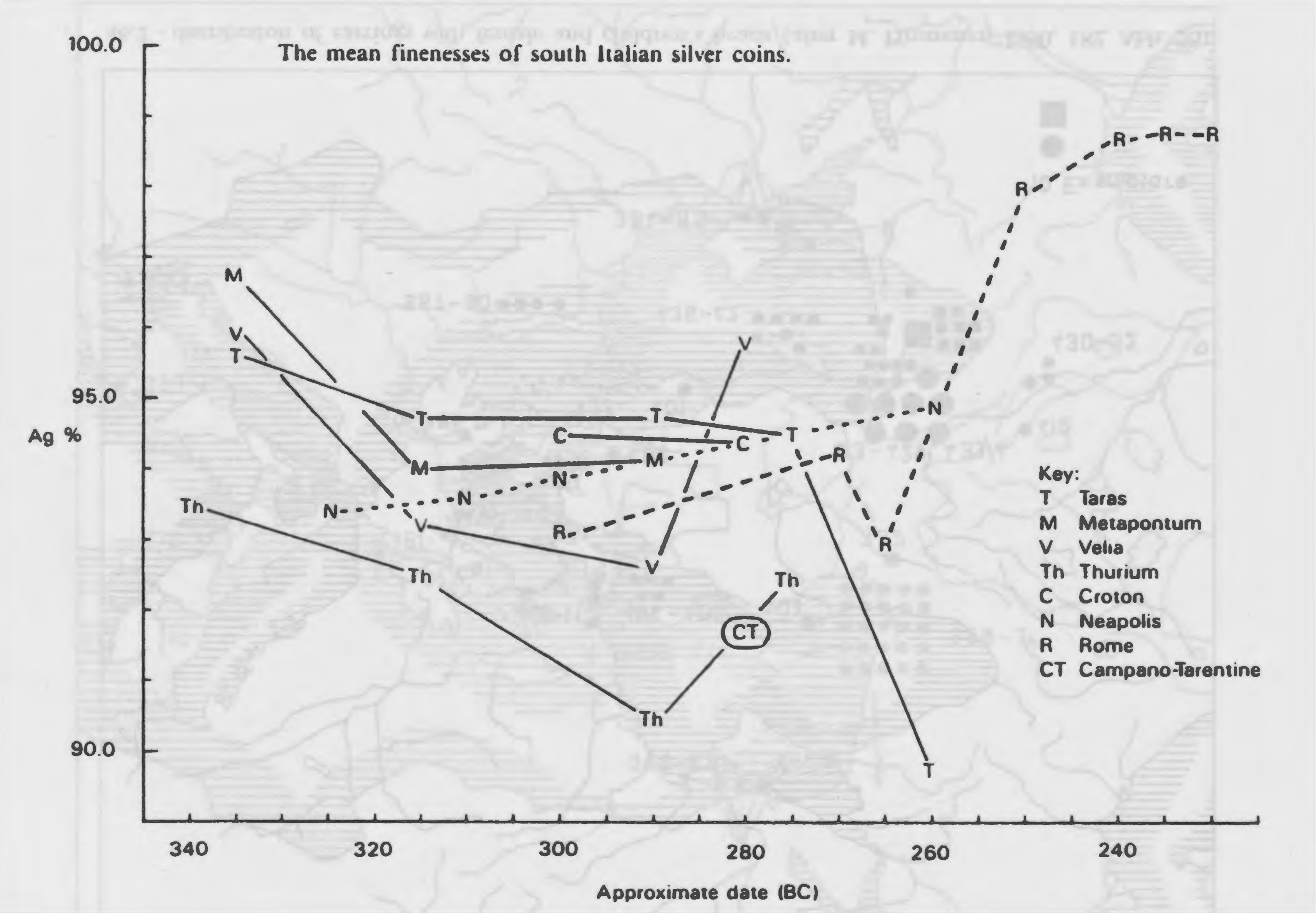

45.2 - distribution map of earrings with dolphin heads (after M. Pfrommer, 1990, 179, Abb. 34).



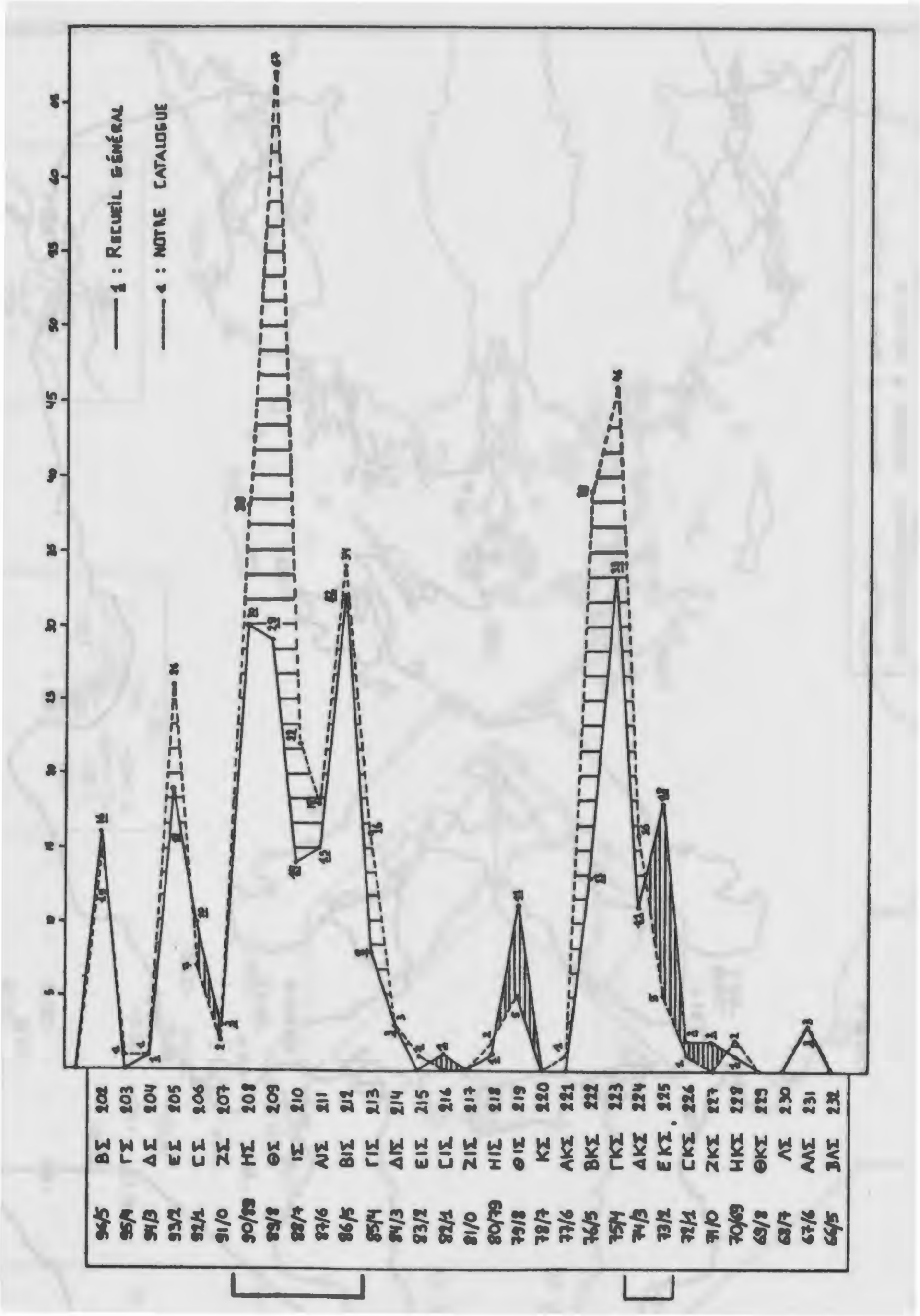
46.1 - distribution map of earrings with lynx heads (after M. Pfrommer, 1990, 178, Abb. 35).



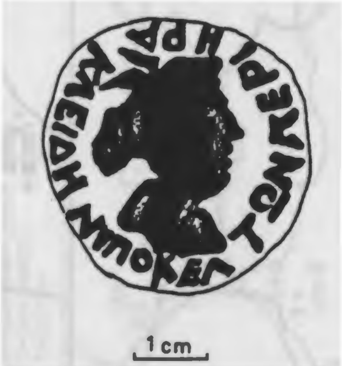

46.2 - distribution of earrings with female and children's heads (after M. Pfrommer, 1990, 182, Abb. 35).



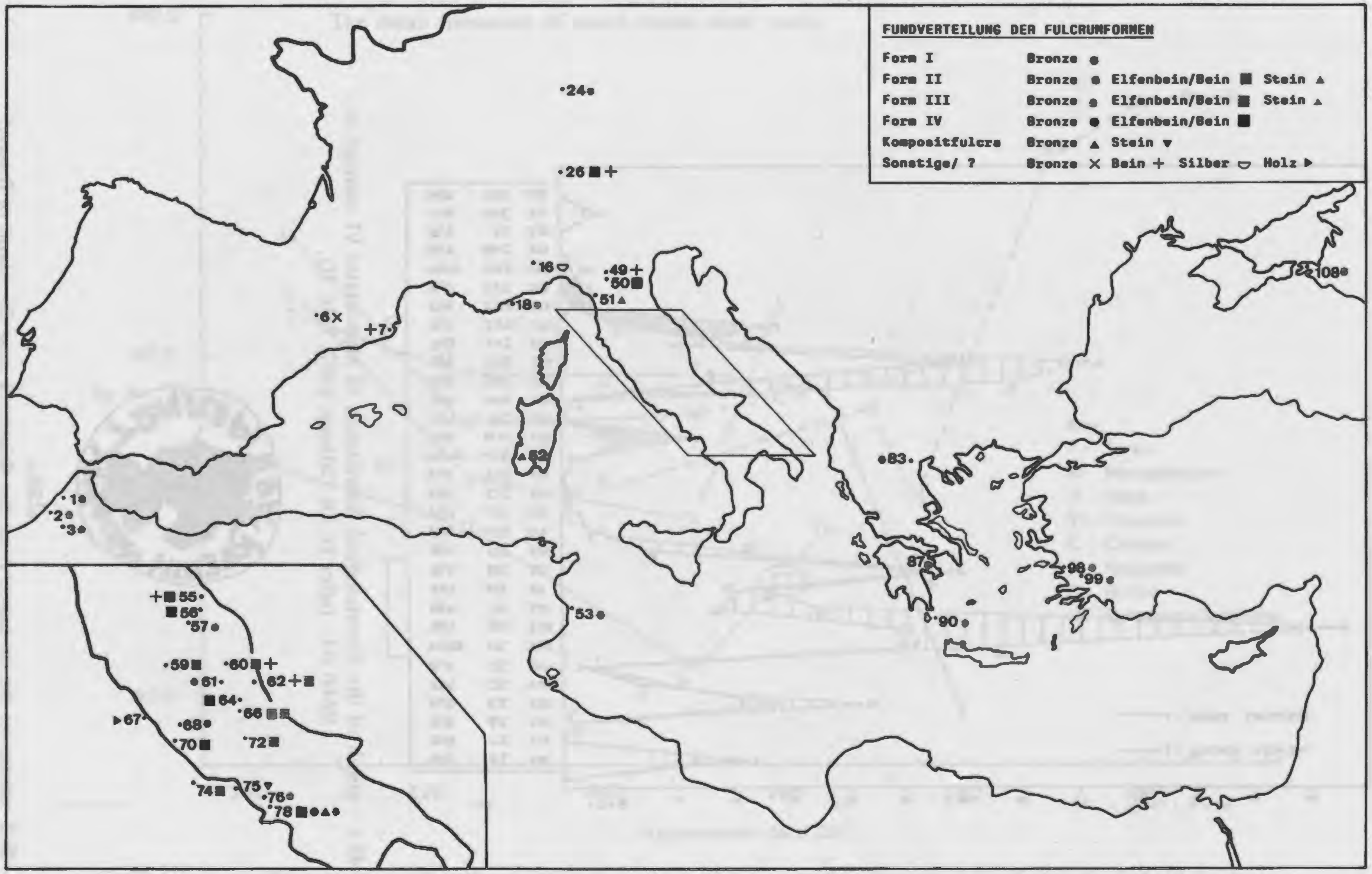

47. The average silver content in Southern Italic silver coins of the second half of the 4th – first half of the 3rd century B.C. (after A.M. Burnett, R. Hook, 1989, 165).



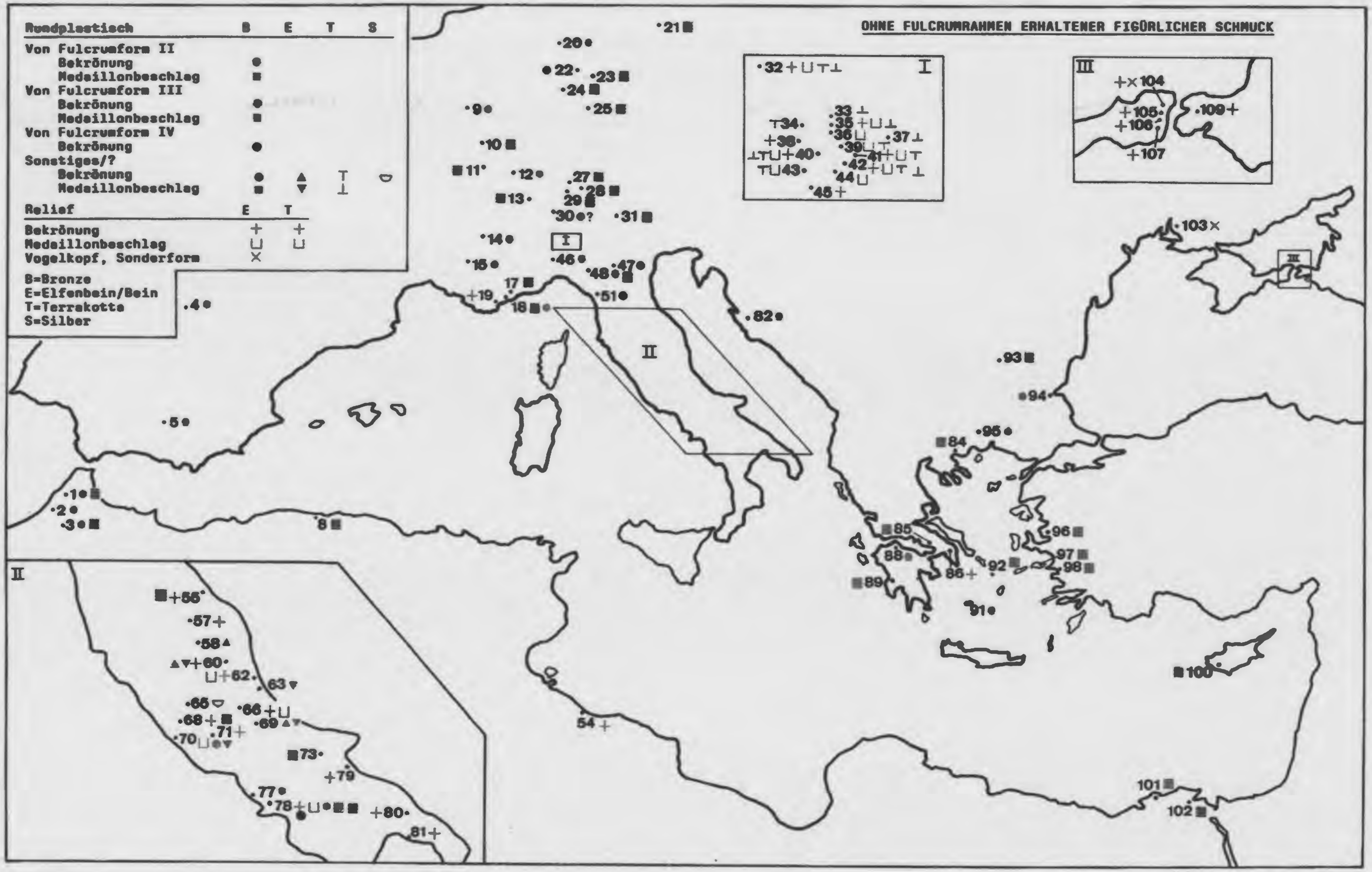

48.1 - graph of the chronological distribution of Mithridates VI coinage in 92-66 B.C. (after Fr. De Callatay, 1987, Tabl. II).




48.2 - stamp on the tin ingots from the shipwreck near the island of Bagaud (after *Gallia Informationes* [1987-88], Fig. 28).




49. Distribution map of the metal details of couches (after S. Faust, 1989, map 1).




50. Distribution map of figural ornaments preserved without couche frames (after S. Faust, 1989, map 2).